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THE DEVONIAN AND LOWER CARBONIFEROUS FAUNAS OF SOUTHERN INDIANA AND CENTRAL KENTUCKY

BY

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SUMMARY OF CONTENTS.

PART I .... 5—9
INTRODUCTION 5
STRATIGRAPHY AND NOMENCLATURE 5
RIVERSIDE SANDSTONE AND NEW PROVIDENCE SHALE.. 6—7
ROCKFORD LIMESTONE 7
NEW ALBANY SHALE .... 7—8
DEVONIAN LIMESTONE .... 8—9

PART II .... 10—33
SECTIONS .... 10—33
SAND CREEK AND WHITE RIVER SECTIONS .... 10—13
THE MUSCATATUCK SECTION .... 13—16
PIXLEY KNOB AND LEXINGTON SECTION .... 16—19
BORDEN SECTIONS .... 19—20
CEMENT QUARRIES .... 20—21
CHARLESTOWN .... 21—22
OHIO FALLS AND EDWARDSVILLE SECTION .... 22—23
GENERALIZED SECTION FROM THE FALLS OF THE OHIO TO EDWARDSVILLE .... 23—25
BEAR GRASS CREEK QUARRIES, NEAR LOUISVILLE .... 25—26
BROOKS SECTION .... 26—28
DEER LICK KNOB .... 28—29
LEBANON JUNCTION, KY 29
NEW HAVEN, KY .... 29—31
RILEY'S, KY 31
PARKSVILLE, KY .... 31—32
CRAB ORCHARD, KY .... 32—33

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PART III .... 34—88
SYSTEMATIC LIST, SHOWING RANGE AND DISTRIBUTION OF SPECIES .... 34—38
Protozoa 34
Cœlenterata .... 34—48
Echinodermata .... 49—52
Vermes 52
Molluscoidea .... 52—69
  Bryozoa .... 52—56
  Brachiopoda .... 57—69
Mollusca .... 69—83
  Lamellibranchiata .... 69—74
  Gastropoda .... 74—80
  Pteropoda .... 80—81
  Cephalopoda .... 81—83
Arthropoda .... 83—86
  Class Crustacea .... 83—86
  Palæostraca .... 83—85
  Entromostraca .... 85—86
Vertebrata .... 86—87
  Pisces .... 86—87
Plantæ 87

PART IV .... 88—111
DISCUSSION AND CORRELATION OF EOCARBONIFEROUS FAUNAS .... 88—111
REVIEW OF PREVIOUS CORRELATIONS .... 88—97
RELATIONS OF THE FAUNAS .... 98—102
ROCKFORD LIMESTONE FAUNA .... 98—100
RIVERSIDE SANDSTONE AND NEW PROVIDENCE SHALE FAUNAS .... 100—102
DEVONIAN FAUNAS .... 102—111
REVIEW OF PREVIOUS CORRELATIONS .... 102—109
CORRELATION OF FAUNAS .... 109—111

PART I.

INTRODUCTION.

The field work on which the present paper is based was done during the summer of '97 under the direction of Prof. H. S. Williams. A few of the sections studied then have been revisited during the last summer while collecting fossils for the United States Geological Survey.

The sections studied extend from the top of the "Knobstone" to the base of the Devonian. The area covered in the field includes a strip of country embracing the outcrops of these formations, which extends from the southern part of Bartholomew county, Indiana, southward to Lebanon Junction, Kentucky, and thence east to Crab Orchard, Kentucky, a distance of about 175 miles.

The facts which have been sought for in making and studying the collections may be referred to four classes of data: Those relating (1) to the geographical variation of the several faunas, (2) to the range and distribution of species, (3) to the relation of the several faunas to each other, and (4) the correlation of the faunas of this region with those of the type sections.

STRATIGRAPHY AND NOMENCLATURE.

The formations containing the faunas under discussion in this paper constitute six terranes whose limits are more or less sharply defined lithologically. Two of these formations are absent over most of the area studied in Kentucky, but all of these are present in southern Indiana.

RIVERSIDE SANDSTONE AND NEW PROVIDENCE SHALE.

The series of sandstone and shales known in the Indiana and Kentucky Reports as the "Knobstones" may be separated into two divisions which are lithologically decidedly unlike in most sections. The uppermost of these divisions consists usually of massive sandstones and sandy shales. Below the sandy shales and sandstones a blue clay shale is found resting either on the Black shale or the Rockford limestone. The name "New Providence shale" was used locally for this division of the "Knobstone" in 1873 by Mr. Borden. He used it to designate the lower Knob shales of Clark county, Indiana. In northern Indiana Mr. Hopkins has called the massive sandstone which is quarried extensively near Riverside P. O. the "Riverside sandstone." A study of a collection of fossils from the Riverside quarries indicates the identity of the Riverside sandstone of Hopkins and the upper division of the "Knobstone."

The "Knobstones" were first classed with a portion of the Lower Carboniferous limestones by Owen under the name of the "Siliceocalcareous series"*. In the revised reprint of Owen's Report published in 1859† the name "knobstones" first appears. It is used, according to the author, to designate "the fine grained free-stones with subordinate beds of grey shales" of the Knob regions. The name "Knobstone" has since been generally used in the Indiana Reports. It is a topographic term derived from the peculiar topographic forms developed in the Knob region of southern Indiana. The name therefore violates the modern rule of stratigraphic nomenclature, which requires the use of a definite geographical name for a geological terrane. The names introduced by Borden and Hopkins are used in the present paper instead of "Knobstones" for this reason, and also because they indicate the divisions of the "Knobstones," which are unlike faunally and lithologically.

The beds of this series reach their maximum development in Brown county, Indiana, where they attain a thickness of about six hundred feet and constitute the only surface rocks over a belt of country more than twenty miles wide. To the north and south the formations thin rapidly, and the Harrodsburg limestone usually extends to within a mile or less of the easternmost outcrop of the Riverside sandstone in southern Indiana and Kentucky. The Riverside sandstone dips to the west or southwest at the rate of from 26′ to 64′* to the mile. This formation usually presents along its eastern outcrop an escarpment from two to four hundred feet high, facing the comparatively level plain formed by the uniform weathering of the Black shale and the Devonian limestone. In northern Indiana Mr. Hopkins† has shown that the lowest member of the Coal measures rests unconformably on the Riverside sandstone.

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*Geol. Recon. of Ind., p. 14, 1837.

†Geol. Recon. of Ind., p. 21, 1859.

In southern Indiana and Kentucky the Harrodsburg limestone (Lower Carboniferous) is the formation which succeeds it.

ROCKFORD LIMESTONE.

The Rockford limestone is a thin bed of limestone from three to six feet thick which separates the Black shale from the New Providence shale. The formation is persistent throughout southern Indiana and is known to extend as far north as Columbus‡. It has not been seen south of the Ohio. Nearly all of the fossils described from it have been obtained near the village of Rockford, from which the formation has received its name. The earliest mention of this limestone seems to have been that of Owen and Norwood in 1847§.

NEW ALBANY BLACK SHALE.

The Black shale has been correlated with various formations. But the only local term which has been used is that given by Borden|| in 1873—the New Albany Black shale. It is a fine-

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*Newsome, Proc. Ind. Acad. Sci. 1897, p. 254.
*Bennett, " " " " " " 259.
*Kindle, " " " " 1895.
†20th. Ann. Rept. Ind. Dept. Geol. and Nat. Hist., pp. 196, 197.
‡Proc. Ind. Acad. Sci., 1897, p. 261.
§Researches among the Protozoic and Carboniferous Rocks of Central Kentucky, made during the summer of 1846; 12 pp.
||Ind. Geol. Rept., 1874, p. 88; 2d. Ann. Rept. 2d. Geol. Surv.

grained, arenaceous black shale, homogeneous throughout, and having a thickness of from 100 to 120 feet in southern Indiana. South of Louisville the New Albany shale becomes greatly reduced in thickness. At Brooks Station it is less than thirty feet thick.

South of the Ohio the New Albany shale has been found resting unconformably on the beds below. Near Brooks Station the shale was found resting unconformably on irregularly eroded Devonian limestone.

DEVONIAN LIMESTONES.

All of the Devonian beds at the Falls of the Ohio below the Black shale were at one time referred to the Upper Helderberg formation by Prof. Hall. He afterwards recognized the two-fold character of the faunas which they contain and correlated them with the Corniferous and Hamilton formations of New York. The Devonian near the Ohio in Indiana and Kentucky is readily separated into two divisions, which are easily distinguished from each other both by lithological and paleontological characters. In order to avoid further possible confusion in referring to the fossils of these divisions it will perhaps be best to use local names instead of the names of the New York formations hitherto used. For the upper portions of these beds, which are very arenaceous and silicious, the name ''Sellersburg beds'' is proposed, to include the beds from the New Albany shale down to the lowest beds worked at the cement quarries. They are extensively worked near Sellersburg for cement. These beds consist of a fine-grained calcareous sandstone from six to twenty feet thick and a thin bed of limestone, which when present lies immediately under the New Albany Black shale.

The limestone lying between the Sellersburg beds and the *Catenipora* beds of the Niagara are well exposed at the Falls of the Ohio between Jeffersonville and the mouth of Silver creek, and may be called the Jeffersonville limestone.

The Devonian formations below the New Albany shale are frequently entirely absent in the Kentucky sections, and where present they are usually represented by only a few feet of strata. The Sellersburg beds have not been seen south of Louisville. The attenuated character of the lower Devonian beds in Kentucky has been generally explained as due to thinning out*. Prof. N. S. Shaler did not recognize any stratigraphic break at the base of the New Albany shale† and regarded it as the equivalent of the New York Devonian formations down to the Oriskany‡, where the Cornifernus was wanting in the Kentucky section. The writer has found sections which show unconformity between the New Albany shale and the beds below in Kentucky. This interval of erosion which has been detected at the base of the Black shale explains the entire absence of the Devonian limestone at many localities and its extreme thinness where present.

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*Pal. N. Y., vol. 5, pt. 2, p. 140.
†Geol. Surv. of Ky., n. ser., vol. 3, p. 174.
‡ " " " " " " " " " 173.

PART II.

SECTIONS.

SAND CREEK AND WHITE RIVER SECTIONS.

Sand creek is one of the eastern tributaries of the East fork of White river, and joins that stream sixty miles north of Louisville. It crosses the Devonian belt from east to west and along its valley occur some of the northernmost outcrops of the Devonian limestone to be met with in the state south of the Wabash valley.

Station 2C.—At Scipio the New Albany shale outcrops just southwest of the Episcopal church at the roadside and contains an abundance of *Styliola fissurella.*

A few hundred yards to the southwest of 2C the Devonian limestone outcrops along a ravine. A small amount of collecting from the limestone a few feet below the Black shale afforded the following species:

Chonetes yandellanus, *Dalmanites* sp., *Glyptodesma erectum*, *Spirifer acuminatus*, *Spirifer varicosus*, *Stropheodonta perplana*, *Stropheodonta demissa*, *Tentaculites bellulus.*

Station 2A.—West of Scipio one and one-half miles, good outcrops of the limestone occur at the side of the wagon road which afforded the following fossils:

Glyptodesma occidentale, *Orthothetes chemungensis arctostriatus*, *Platyceras carinatum*, *Polypora* sp., *Proetus* sp., *Proetus microgemma*, *Spirifer acuminatus*, *Stropheodonta demissa*, *Stropheodonta inequistriata*, *Stropheodanta perplana*, *Tentaculites* sp.

Station 1B.—At an old quarry on the south side of Sand creek three-fourths of a mile above Helt's mill about eight feet of limestone is exposed, containing an abundance of fossils. Those obtained were:

Onychodus sigmoides?, *Pleurodictyon problematicum*, *Polypora* sp?, *Proetus canaliculatus?*, *Spirifer acuminatus*, *Stropheodonta demissa*, *Stropheodonta perplana*, *Tentaculites bellulus.*

Spirifer acuminatus is the predominant species and is very abundant here.

Below the quarry a hard grey magnesian limestone, which is probably of Niagara age, is exposed. No fossils were found in it.

Station 1A.—At Helt's Mill the broken dam gives access to the Black Shale, which outcrops above it in the bed of the stream and rises a few inches above the water level. The shale forms the bed of the mill-race and has an outcrop of several square yards on the south side of the creek directly below the dam. On the opposite side of the stream, however, there is an exposure of hard dark blue to black limestone instead of the shale. The following fossils were collected from the Black shale:

Cardiopsis sp., *Chonetes lepida* (a), *Leiorhynchus limitaris* (a), *Tentaculites fissurella* (a).

Station 4A.—About three and one-half miles west of North Vernon, along the Seymour and North Vernon road, limestone is well exposed along the banks of a small stream. The fossils found here are:

Chonetes yandellanus? (r), *Pleurodictyon problematicum* (a), *Spirifer acuminatus* (c), *Spirifer varicosus* (r), *Streptorhynchus chemungensis* var. *arctostriatus*, *Stropheodonta demissa* (a), *Stropheodonta hemispherica* (c), *Stropheodonta perplana* (c), *Tentaculites scalariformis* (c).

About eight miles below the mouth of Sand creek at Rockford the Rockford limestone outcrops in the bed of the river, but no fossils were obtained at the time of my visit owing to the stage of the water. This is the type locality of the Kinderhook fauna and the following is a list of the species which have been described or reported from it.

Rockford fossils—

Cœlenterata: *Sphenopterium enorme* M. and W. (Winchell) (Meek and Worthen); *Zaphrentis ida* Win., (Winchell).

Echinodermata: *Synbathocrinus oweni* Hall, (Hall).

Brachiopoda: *Athyris biloba* Win., (*Spirigera biloba*) (Winchell); *Chonetes geniculata* White, (Winchell); *Chonetes illinoisensis* Worthen, (Schuchert); *Chonetes illinoisensis* Worthen, (Winchell); *Productus concentricus* Hall, (Winchell); *Reticularia cooperensis* Hall, (*Spirifer semiplicatus*) (Hall), (Meek and Worthen); *Rhipidomella occasus* Hall, (*Orthis occasus*) (Hall); *Rhynchonella missouriensis* Shum., (Meek and Worthen); *Rhynchonella obsolescens* Hall, (Hall); *Rhynchonella ? tetraptyx* Win., (Winchell).

Pelecypoda: *Anatina leda* Hall, (Hall); *Aviculopecten tenuicostus* Win., (Winchell); *Cardiomorpha radiata* M. and W., (Meek and Worthen); *Cypricardia ventricosa* Hall, (Hall); *Megambonia lyoni* Hall, (Hall); *Nucula hians* Hall (Hall).

Gastropoda: *Bellerophon cyrtolites* Hall, (Hall); *Bellerophon lineolatus* Hall, (Hall); *Euomphalus lens* Hall, (Hall); *Euomphalus spirorbis* Hall, (Hall); *Loxonema turritiforme* Hall, (Hall); *Murchisonia* (*Pleurotomaria ?*) *limitaris* Hall, (Hall); *Pleurotomaria ? mitigata* Hall, (Hall); *Pleurotomaria vadosa* Hall, (Hall); *Pugiunculus ?* (*Theca*) *aculeatus* Hall, (Hall).

Cephalopoda: *Goniatites ixion* Hall, (Hall); *Goniatites lyoni* Meek and Worthen, (Meek and Worthen); *Gyroceras gracile* Hall, (Hall); *Nautilus* (*Discus*) *digonus* M. and W., (Meek and Worthen); *Nautilus* (*Discus*) *trisulcatus* M. and W., (Meek and Worthen); *Nautilus rockfordensis* Win., (Winchell); *Nautilus* (*Tremodiscus*) *discoidalis ?* Win., (Winchell); *Orthoceras icarus* Beecher, (Beecher); *Orthoceras indianensis* Beecher, (Beecher); *Orthoceras marcellensis* (Vanuxem) (Jas. Hall).

Trilobitæ: *Phillipsia doris* (Hall) Win., (Hall) (Winchell; *Phillipsia rockfordensis* Win., (Winchell).

Pisces: *Otodus multicarinatus* Nor. and W., (Norwood and Worthen.)

The Black shale outcrops on the east bank of White river two miles above Rockford, exposing a thickness of ten or twelve feet. A half day's digging at this point failed to discover any fossils.

Station 5B.—Southwest of Brownstown is a range of "Knobs" known as Chestnut Ridge. The massive buff sandstone capping these hills was found to be full of fossils at a small quarry near the top of one of the knobs, one and one-half miles southeast of Brownstown, south of the Brownstown and Tampico road. The following species were obtained here from the Riverside sandstone:

Aulopora sp. r, *Aviculopecten* sp. r, *Camarotœchia sappho* c, *Conularia newberryi* r, Crinoid stems r, *Cypricardinia* sp. c, *Cryptonella eudora* r, *Derbya keokuk* a, *Dielasma?*, *Lingulodiscina newberryi* Hall r, *Leiorhynchus newberryi?* r, *Macrodon* sp. c, *Orthoceras* sp. r, *Pleurotomaria* sp., *Productus newberryi* c, *Platyceras* sp., *Reticularia pseudolineata* a, *Rhynchonella* sp. r, *Schizodus triangularis* r, *Spirifer keokuk* a, *Spiriferina depressa* c, *Spiriferina* sp., *Streblopteria* sp. c, *Syringothyris* sp. r.

The New Providence shale forms the lower portion of the hills here and the beds of the streams. No fossils were found in it save worm trails, which are everywhere abundant, and a single specimen of *Spirifer mortonanus*, which was broken out of the shelly sandstone in the bed of a small ravine about one mile northeast of station K5B.

THE MUSCATATUCK SECTION.

The outcrops included in this section extend from the eastern limit of the Devonian near Wirt station in Jefferson county to Ft. Ritner at the eastern edge of the Harrodsburg limestone in Lawrence county, a distance of about forty miles.

The easternmost stations of this section are those at Lancaster, on the west side of Big creek. The bed of the creek here is in the Upper Silurian rocks, while the upper part of the bluffs are of Devonian limestone, full of fossil corals and brachiopods. Just below Mr. George Ferris' house the coral beds are well exposed.

Station 10B.—On the west bank of the creek just above the bridge the following fossils were obtained:

Atrypa aspera r, *Atrypa reticularis* a, *Glyptodesma occidentale* r, *Onychodus sigmoides* c, *Orthis iowensis* a, *Phacops* *rana?* c, *Pleurodictyon problematicum* c, *Pterinea flabellum?* r, *Rhynchonella tethys* r, *Spirifer acuminatus* a, *Spirifer davissi*, *Spirifer fornaculus* r, *Spirifer varicosus* c, *Streptorhynchus* sp. r, *Stropheodonta concava* r, *Stropheodonta hemispherica* c, *Stropheodonta* sp., *Tentaculites scalariformis* r.

Station 10B′.—The Devonian limestone here is full of flint concretions of all sizes, which contain beautifully preserved fossils. The following were obtained from weathered masses of flint on Mr. George Ferris' land a short distance north of station 10B:

Actinopteria boydi r, *Bucania devonica* r, *Clinopistha subnasuta* r, Crinoid stems r, *Cyclonema cancellatum* r, *Glyptodesma erectum* r, *Glyptodesma occidentale* a, *Orthis propinqua* r, *Platyceras erectum* r, *Platyostoma lineatum* r, *Pleurotomaria sulcomarginata* r, *Rhynchonella tethys* r, *Spirifer acuminatus* a, *Spirifer euruteines* a, *Spirifer varicosus* r, *Streptorhynchus arcostriata* r, *Stropheodonta concava* c, *Stropheodonta demissa* a, *Stropheodonta hemispherica* c, *Stropheodonta perplana* c.

The fossils in the lower part of the bluff are chiefly corals.

At the ford one and one-half miles east of Paris Crossing, Upper Silurian rocks form the bed of the stream, while the Jeffersonville limestone constitutes the upper twenty or thirty feet of the bluffs.

Station 9C.—The following species were obtained from the top of the bluff near the spring:

Atrypa reticularis c, *Chonetes arcuatus* a, *Chonetes pusillus* c, *Glyptodesma occidentale*, *Orthis iowensis* c, *Onychodus sigmoides* c, *Rhynchonella tethys* c, *Spirifer acuminatus* a, *Spirifer iowensis* c, *Stropheodonta demissa* c, *Tentaculites bellulus* c.

Spirifer acuminatus is extremely abundant and the predominant form at this station. *Chonetes arcuatus* is very abundant and stands next to *Spirifer acuminatus* in the number of individuals.

Station 8A.—About one and one-half miles west of Paris Crossing the Sellersburg limestone and a few feet of Black shale above it are exposed in a small quarry on the south side of the road. The following fossils, representing a Hamilton fauna, were obtained from the limestone:

Atrypa reticularis r, *Chonetes arcuatus* a, *Cladopora* a, Crinoid stems a, *Cyrtina hamiltonensis?* r, *Onychodus sigmoides* r, *Product-*

ella subaculeata var. *cataracta* c, *Schizophoria striatula* c, *Spirifer byrnesi* c, *Spirifer granuliferus* r, *Spirifer grieri ?*, *Spirifer iowensis* (*Spirifer pennatus*) c, *Stropheodonta demissa*, *Stropheodonta hemispherica*, *Stropheodonta perplana* c.

Station 8B.—The following species were obtained from the three and one-half feet of Black shale outcropping above the limestone:

Chonetes lepidus a, *Lingula spatulata* a, *Tentaculites fissurella* a.

Station 7A.—At the wagon bridge over the Muscatatuck one mile below Crothersville the New Albany shale outcrops in the bed of the stream, and *Lingula spatulata* was found here abundantly.

Station 7B.—Just below the bridge the Rockford limestone is well exposed above the shale. It has here a thickness of five feet, and afforded the following fossils:

Ambocœlia gregaria a, *Athyris* nov. sp., *Chonetes geniculatus* White ? a, *Chonetes illinoisensis* Win. c, *Chonetes logani* N. and P ? r, Crinoid stems c, *Goniatites lyoni* M. and W. r, *Goniatites oweni* Hall c, *Leiorhynchus ?*, *Leperditia* sp. r, *Nucula* nov. sp., *Orthoceras icarus* Hall r, *Orthoceras indianense* Hall c, *Palæoneilo* sp. r, *Phillipsia doris* (H.) Win. c, *Platyceras* sp. r, *Pleurotomaria* sp. r, *Productella concentrica* Hall ?, *Rhipidomella ocassus* Hall ?, *Rhombopora ?*, *Rhynchonella obsolescens* H.? r, *Spirifer* sp., *Spirifer marionensis* Shum.? c, *Spiriferina solidirostris* a, *Zaphrentis* sp. r.

Five or six miles west of the last station the flat country, which is underlaid by the Black shale and Rockford limestone, gives way to the belt of knobs, which is here about twenty miles wide.

Station 22A.—At Low Gap ridge, near Lesterville, Washington county, fossils were found abundantly in the Riverside sandstone. At the "gap," which is about one mile north of the school house, the following fossils were obtained:

Camarotœchia sappho c, *Chonetes logani* a, *Derbya keokuk* c, *Myalina keokuk* c, *Orthothetes crenistria ?* r, *Pleurodictyon problematicum* r, *Productus newberryi* a, *Productus semireticulatus* c, *Spirifer keokuk* r, *Syringothyris texta* a, *Tentaculites* sp. r.

Station 22B.—A quarter of a mile S. E. of the school house on Low Gap ridge some of the strata exposed at the roadside are very fossiliferous and furnished the following species:

Allorisma sp. r, *Aviculopecten* sp. c, *Camarotœchia sappho* a, *Cypricardinia* sp., *Cryptonella eudora ?* r. *Derbya keokuk* a, *Discina* sp. c, *Grammysia* sp. r, *Leiropecten* sp. c, *Mytilarca ?* r, *Platyceras* sp. c, *Pleurotomaria* sp. a, *Proetus auriculatus* r, *Reticularia pseudolineata* a, *Spirifer ?* sp., *Spirifer keokuk* a, *Spiriferina* sp., *Spiriferina depressa* c, *Streblopteria gracilis* c, *Streblopteria media* c.

The western limit of the Riverside sandstone along this section is found about one and one-half miles east of Ft. Bitner, Lawrence county.

PIXLEY KNOB AND LEXINGTON SECTION.

This section crosses the Devonian and "Knob" region in a northeasterly and southwesterly direction, extending from Kent P. O. through Lexington and the Guinea "knobs" and ending at Pixley's "knob," about five miles west of Henryville. The stations are from eight to twenty miles south of those of the Muscatatuck section.

Station 11A.—On the west side of the creek near Kent P. O. the Jeffersonville limestone is well exposed in the banks of the stream. Just north of the old saw-mill the coral beds are well exposed and contain few other fossils than corals.

Aulopora serpens ?, *Cladopora ?*, *Diphyphyllum* sp. a, *Zaphrentis* sp. c, *Zaphrentis compressa* r.

Station 11B.—On the south side of the road opposite the saw-mill, at a slightly higher level than the coral beds of the last station, the following fossils were obtained:

Atrypa reticularis a, *Chonetes* sp. r, *Spirifer curuteines* r, *Spirifer iowensis* c, *Terebratula lincklæni* H. r.

Station 11C.—The slope of the hill northwest of the saw-mill is strewn with numerous masses of flint weathered from the limestone, which contains beautifully preserved fossils. The following were obtained from these flint nodules:

Bellerophon sp., *Bucania devonica* r, *Callonema bellatulum* r, *Crania doria* r, *Cyrtina hamiltonensis* c, *Glyptodesma occidentale* c, *Loxonema hydraulicum;* *Orthis striatula* a, *Orthis vanuxemi* a, *Palæoncilo* sp., *Platyceras buculentum* r, *Platyceras erectum* c, *Platyostoma lineatum* var. *callosum* r, *Productella subaculeata* var. *cataracta* r, *Proetus crassimarginatus*, *Rhynchonella tethys* r, *Spirifer acuminatus* c, *Spirifer arctisegmentus* r, *Spirifer segmentus* r, *Spirifer varicosus* r, *Streptorhynchus arctostriatus* r, *Stropheodonta demissa* a, *Stropheodonta hemispherica* c, *Stropheodonta perplana* a.

Lexington.—In the vicinity of Lexington the Sellersburg beds and the New Albany shale are exposed and afford excellent opportunities for collecting. The upper eight or ten feet of the beds just below the shale are very silicious, almost a sandstone. On exposed slopes the fossils from these beds weather out in an excellent state of preservation. Directly below these silicious beds is a blue limestone, replete with *Orthis vanuxemi* and *Orthis striatula*. I obtained the following species from these beds at a small quarry a quarter of a mile north of the railroad station.

Station 12A.—

Orthis striatula a, *Orthis vanuxemi* a, *Spirifer byrnesi* c, *Spirifer euruteines* c, *Stropheodonta hemispherica* c.

Station 12A′.—Just below these *Orthis* beds is the Jeffersonville limestone, in which the more common species at this quarry are the following:

Platyceras erectum r, *Spirifer acuminatus* c, *Strictopora* sp., *Stropheodonta demissa* c, *Stropheodonta hemispherica* a.

Station 12B′.—From the Sellersburg beds just below the New Albany shale, a few rods northeast of the railroad station at Lexington, the following species were secured:

Chonetes sp., *Chonetes yandellanus* a, *Cystiphyllum* sp.?, *Phacops rana* r, *Proetus canaliculatus?* r, *Roemerella grandis* r, *Spirifer oweni* c, *Stropheodonta demissa* c, *Stictopora* sp. c, *Tropidoleptus carinatus* a.

Station 12B″.—From the Sellersburg beds one-half mile south of the railroad station, just east of the track, the following species were collected:

Athyris vittatus r, *Atrypa reticularis* c, *Aulopora* sp. r, *Camarotœchia tethys?* r, *Chætetes arbusculus?* r, *Coleolus aciculum*, *Hyolithes* sp., *Macrocheilus carinatus* r, *Macrochilina* n. sp. r, *Microcyclas* sp. c, *Modiomorpha concentrica* r, *Paracyclas ellipticus* r, *Spirifer byrnesi* a, *Spirifer euruteines* r, *Spirifer segmentus?* r, *Spirifer varicosus* a.

Station 12B.—One mile east of Lexington the following species were found in the same beds as the last station, on Dr. Davis' land south of the road:

Atrypa reticularis c, *Discina grandis* r, *Spirifer granulosus* a, *Stictopora* sp. c.

Station 12C.—In the bed of a small ravine a few hundred yards above Dr. Davis' house the New Albany shale is encountered, and the lower layers of it contain in great abundance the following species:

Chonetes lepidus c, *Leiorhynchus quadricostatus* a, *Tentaculites fissurella* a, *Tentaculites gracilistriatus* r.

Powers' collection.—The following is a list of the species in a collection made by Mr. John Powers at Lexington and kindly loaned to the writer for study:

Athyris vittata, *Bellerophon leda*, *Callonema imitator*, *Camarotœchia carolina*, *Camarotœchia congregata*, *Cyrtoceras jasoni*, *Favosites* sp., *Glossites* sp., *Gomphoceras minum*, *Loxonema hydraulicum*, *Machæracanthus major*, *Modiomorpha concentrica*, *Orthoceras* sp., *Paracyclas elliptica*, *Platyceras erectum*, *Proctus canaliculatus*, *Spirifer byrnesi*, *Spirifer varicosus*.

Station 13A.—Southwest of Lexington five and one-half miles, in the Guinea "knobs" the Rockford limestone is well exposed at John Koerner's. The following fauna was obtained here:

Ambocælia gregaria (Win.) Schu. c, *Athyris ohioensis* Win.?, *Bellerophon* sp., *Cryptonella? inconstans* r, *Phillipsia doris* (H.) Win. a, *Productella* sp.? r, *Spirifer marionensis* Shum. c, *Spiriferina solidirostris*.

Station 24A.—The New Providence shale is well exposed at the side of the wagon road which ascends Pixley knob. This is one of the very few localities where this shale was found to be fossiliferous in southern Indiana. The species which were found here are the following:

Athyris lamellosa c, *Athyris ohioensis?* r, *Atrypa* sp. r, *Bellerophon crytolites?* r, *Camaortœchia* sp., *Chonetes illinoisensis* c, *Chonetes logani* c, *Crenipecten fœrstii?* r, Crinoid stems a, *Cyclonema* sp., *Cyrtina?* r, *Forbesocrinus* sp. r, *Macrodon* sp., *Nucula* sp., *Orthothetes* sp., *Palæoneilo bedfordensis* c, *Platyceras* sp., *Pleurotomaria* sp., *Polyphemopsis* sp.? r, *Productus arcuatus?* a, *Productus gracilis* r, *Productus pyxidatus* c, *Productus semireticulatus* c, *Productus shumardanus?* c, *Rhynchonella* sp. r, *Scaphiocrinus* sp. r, *Spirifer keokuk* a, *Spirifer suborbicularis* c, *Spiriferina* sp., *Syringothyris* sp. r, *Zaphrentis* sp.

Station 23A.—North of Bartel P. O., Washington county, the shelly ferruginous sandstone of the Riverside formation exposed at the roadside contains an abundant fauna, from which the following species were collected:

Aulopora sp. c, *Bellerophon* sp., *Bellerophon crassus* r, *Bellerophon galericulatus* Win?, *Camarophoria* sp., *Camarotœchia sappho* a, *Chonetes illinoisensis* a, *Conocardium pulchellum* r, *Cypricardinia Edmonia* sp., *Goniatites greeni* r, *Macrodon* sp., *Naticopsis* sp., *Orthoceras* sp. r, *Orthothetes crenistria* c, *Phæthonides* sp. nov.? r, *Productus semireticulatus* c, *Productus newberryi*, *Proetus auriculatus* (H.) c, *Ptychopteria sexplicata*, *Spirifer keokuk*, *Spirifer pseudolineata* c, *Spirifer tenuispinatus* r, *Spiriferina depressa* (H.)? a, *Strophostylus* sp., *Streptorhynchus* sp., r, *Zaphrentis* sp. r.

BORDEN SECTIONS.

The Riverside sandstone is well exposed near Borden and fossils were found in it abundantly at two or three localities.

Station 14A.—West of Borden about one and one-half miles the sandstone outcropping in the wagon road one-half a mile north of the railroad contains the following species:

Camarotœchia sappo c, *Chonetes* nov. sp., Crinoid stems c, *Cypricardella* sp. r, *Derbya keokuk* a, *Hyolithes* sp. r, *Macrodon* sp. a, *Myalina keokuk* c, *Orthoceras* sp., *Pleurotomaria* sp., *Productus newberryi* c, *Productus semireticulatus* c, *Pterinopecten* sp. r, *Schizodus chemungensis* r, *Sphenotus?* sp., *Sphenotus valvulus?* r, *Syringothyris texta* a.

Station 14B.—On the west side of Saw-mill branch a half mile south of Borden the Riverside sandstone is fossiliferous toward the top of the hill where exposed at the roadside. The following fauna was found here:

Camarotœchia sappho a, *Derbya keokuk* a, *Leiopteria* sp., *Orthothetis crenistria?* r, *Pentremites* sp. r, *Productus gracilis* r, *Spathella typica* r, *Syringothyris textus* c.

Spirophyton crassum was found in the Riverside sandstone along Saw-mill branch south of Borden.

CEMENT QUARRIES.

The fine-grained calcareous sandstone lying just below the Black shale is quarried for cement at a number of localities in Clark county. These silicious beds are usually from ten to fifteen feet in thickness. The name Sellersburg beds has been given them in this paper from the name of the town near which they are extensively quarried. At the quarry of Speed & Co., near Sellersburg, the rock is a bluish grey fine grained sandstone four feet thick.

Station 19A.—Speed & Co.'s cement quarry, one and one-half miles north of Sellersburg. The species obtained here are:

Atrypa reticularis c, *Chonetes yandellanus* a, *Orthis* sp., *Rynchonella tethys* r, *Spirifer granuliferus* r, *Spirifer segmentus* c, *Spirifer varicosus* r, *Stropheodonta demissa* r.

Station 19B.—Speed & Co.'s cement quarry, one and one-half miles north of Sellersburg.

The following species were collected from the weathered clay near the quarry and represent the same fauna as 19A.

Athyra vittata a, *Atrypa reticularis* a, *Chonetes yandellanus* a, Crinoid stems c, *Loxonema hydraulicum* r, *Proetus ?* r, *Spirifer byrnesi* r, *Spirifer euruteines* r, *Spirifer granulosus* a, *Spirifer varicosus* r, *Stropheodonta demissa* c.

Station 19A'.—Limestone quarry one-half mile east of Sellersburg.

The rocks exposed at the quarry belong to the Jeffersonville limestone and afforded the following species:

Atrypa reticularis r, *Chonetes mucronatus* r, *Favosites emmonsii* r, *Michelinia favositoidea* r, *Orthis iowensis* c, *Spirifer acuminatus* c, *Spirifer gregarius* a, *Stropheodonta demissa* c, *Stropheodonta hemispherica* c, *Stropheodonta perplana* r, *Strophomena rhomboidalis* a.

The following section is exposed at the cement quarry just west of Watson:

Surface clay	3′	
Black shale		18″
Argillaceous sandstone with chert	5′	18″
Fine grained sandstone ("Cement rock")	9′	

Station 18A.—Cement quarry at Watson.

The following species were obtained from the fine grained sandstone:

Athyris vittata a, *Atrypa reticularis* c, *Chonetes yandellanus* a, *Fenestella* sp. c, *Lichenalia* sp. c, *Michelinia favositoidea* r, *Spirifer byrnesi* c, *Spirifer granuliferus* a, *Spirifer iowensis* c, *Spirifer varicosus* a, *Stropheodonta demissa* a, *Stropheodonta hemispherica* c.

Station 18B.—Cement quarry at Watson.

The fossils in this list are from the residual clay at the quarry and represent the same fauna as at 18A.

Athyris spiriferoides?, *Athyris vittata*, *Atrypa reticularis* Hall a, *Camarotœchia congregata* H., *Chonetes yandellanus?* a, *Meristella haskinsi* Hall, *Meristella unisulcata*, *Orthis livia* Billings, *Paracyclas elliptica* Hall, *Phacops rana* Hall, *Schizophoria striatula* Schlot., *Spirifer davisii* Nettleroth, *Spirifer fornaculus* Hall, *Spirifer granulosus* Hall, *Spirifer oweni*, *Spirifer segmentus* Hall, *Spirifer varicosus* Hall, *Zaphrentis* sp.

CHARLESTOWN.

Fourteen Mile creek cuts through the Jeffersonville limestone and exposes the Niagara sandstone and shale along the sides of its valley a short distance east of Charlestown. The abundance of well-preserved Devonian fossils in the residual limestone clay about Charlestown has long made it a favorite locality for collectors. The following Devonian species from Charlestown are in the Indiana State Museum:

Athyris vittata c, *Atrypa reticularis* c, *Loxonema hydraulicum* c, *Microdiscus* sp. c, *Nucula niotica* c, *Spirifer granuliferus* r, *Spirifer gregarius* r, *Spirifer segmentus* r, *Stropheodonta hemispherica* r.

The specimens from stations 20A and 20B are from clays which have been produced by the weathering of the Jeffersonville limestone and the Sellersburg beds, and hence are representative of both formations.

Station 20C.—Three and one-half miles east of Charlestown.

The following fauna was collected at the roadside:

Atrypa reticularis r, *Bucania devonica* c, *Chonetes mucronatus* c, *Chonetes yandellanus* c, *Conocardium trigonale* r, *Discina grandis* r, *Glyptodesma occidentale*, *Orthis iowensis* c, *Polypora* sp., *Proetus* sp. r, *Spirifer acuminatus* c, *Spirifer byrnesi* r, *Spirifer gregarius* a, *Stropheodonta demissa* c, *Stropheodonta hemispherica* c, *Stropheodonta perplana c.*

The following species from Charlestown, Indiana, are in the State Museum:

Atrypa aspera, *Camarotœchia tethys*, *Chonetes yandellanus*, *Cyrtina hamiltonensis* Hall, *Meristella nasuta*, *Orbiculoidea ampla* Hall, *Orbiculoidea seneca* Hall, *Schizophoria propinqua ?*, *Spirifer consobrinus* d'Orbig, *Spirifer euruteines*, *Spirifer granulosus* Hall, *Spirifer pennatus* Atwater, *Stropheodonta demissa* Hall, *Stropheodonta hemispherica* H.

Station 20A.—East of Charlestown, near Fourteen creek.

The following species were picked up from the residual clay at the roadside:

Bucania devonica, *Microdiscus* sp. c, *Spirifer acuminatus* a, *Spirifer euruteines* r, *Spirifer gregarius* a, *Stropheodonta demissa* r.

Station 20B.—Three miles east of Charlestown in an old field.

OHIO FALLS AND EDWARDSVILLE SECTION.

The Niagara limestones which are so well exposed just east of Louisville are brought below the bed of the Ohio at the Falls by the westerly dip of the beds, which is probably 25′ or 30′ to the mile.

The Devonian beds are well exposed along the north bank of the Ohio almost to the mouth of Silver creek, where their outcrops are succeeded by those of the New Albany shale. At New

Albany the Rockford limestone is about three feet in thickness in the bed of the stream at the northwest side of the town. Just west of New Albany the New Providence shale is well exposed along the track of the Air Line railroad. The massive sandstone of the Riverside formation which follows this shale is well exposed at the tunnel near Edwardsville, four miles west of New Albany.

The following is a connected section of the rocks exposed between the Falls of the Ohio and Edwardsville:

GENERALIZED SECTION FROM THE FALLS OF THE OHIO TO EDWARDSVILLE.

7.	Harrodsburg limestone	
6.	Riverside sandstone (massive to shelly sandstone and sandy shales)	200′
5.	New Providence shale (blue arenaceous shales)	125′
4.	Rockford limestone	3′
3.	New Albany Black shale	104′
2.	Sellersburg beds	15′
1.	Jeffersonville limestone	20′

The entire thickness of the Jeffersonville limestone is not shown in any single section, but its thickness probably does not exceed twenty feet in the vicinity of the Falls of the Ohio.

Station 17A′.—Falls of the Ohio.

The following list of species is from the Jeffersonville limestone on the north bank of the river about a half mile below the J. M. & I. bridge:

Atrypa aspera r, *Atrypa reticularis* a, *Blothorphyllum decorticatum* c, *Chonetes* sp. *r*, *Conocardium trigonale ?* r, *Cyrtina hamilton-*

ensis r, *Discina* sp., *Diphyphyllum* sp., *Favosites hemisphericus* c, *Michelinia cylindrica* c, *Orthis livia* r, *Pentamerus nucleus ?* r, *Platyceras dumosum* r, *Platystoma lineatum* r, *Productella subaculeata* var. *cataracta* r, *Proetus canaliculatus* r, *Spirifer arctisegmentus* r, *Spirifer byrnesi* r, *Spirifer euruteines* r, *Spirifer gregarius* a, *Stropheodonta demissa* c, *Stropheodonta hemispherica* c, *Stropheodonta perplana* r, *Thecia minor* c, *Trochonema rectilatera* r, *Zaphrentis gigantea*, *Zaphrentis ungula* c.

Station 17B.—Near the government jetty on the Indiana side of the Falls.

The following species were obtained from about 3′ of the lowest beds exposed at low water:

Blothrophyllum sp. c, *Conocardium cuneus* a, *Favosites hemisphericus* c, *Holopea* sp. r, *Modiomorpha mytiloides* r, *Pentamarella arata* r, *Pleurotomaria* sp. r, *Proetus crassimarginatus* c, *Proetus microgemma* r, *Spirifer gregarius* r, *Spirifer varicosus* r, *Stropheodonta demissa*, *Stropheodonta perplana* r, *Terebratula lincklæni* c, *Zaphrentis giganteus* a.

Station 17B′.—Immediately above 17B the following species were obtained from about two feet of hard grey limestone:

Actinopteria boydi r, *Atrypa reticularis* c, *Callonema bellatulum* c, *Callonema imitator ?* c, *Chonetes mucronatus* c, *Conocardium cuneus* a, *Cyathophyllum rugosum* c, *Cyrtina hamiltonensis* r, *Dalmanites anchiops* var. *sorbrinus* r, *Dalmanites selenurus* r, *Glyptodesma occidentale* r, *Modiomorpha affinis* a, *Modiomorpha mytiloides* a, *Orthis iowensis ?* r, *Proetus crassimarginatus* c, *Ptychodesma* n. sp. r, *Stropheodonta arctostriatus* r, *Stropheodonta demissa* c, *Stropheodonta perplana* r, *Turbo shumardi* c, *Zaphrentis giganteus* c.

Station 17B″.—About six feet above B′ the limestone beds afforded the following species:

Atrypa reticularis c, *Chonetes mucronatus* c, *Proetus crassimarginatus ?* c, *Spirifer acuminatus* c, *Stropheodonta demissa* c, *Stropheodonta hemispherica* c.

Station 17A.—Near the south end of the J. M. & I. railroad bridge the fine grained calcareous sandstones lying just below the Black shale are quarried for cement. Three or four feet of rather pure limestone separates these sandy beds from the Black shale above. The ''cement beds'' here afforded the following species:

Atrypa reticularis a, *Chonetes yandellanus* a, *Leiorhynchus quadricostatum* c, *Proetus* sp., *Spirifer oweni* a, *Spirifer segmentus* c, *Spirifer subattenuatus* r, *Stropheodonta demissa* r.

No fossils were found in the Rockford limestone at New Albany.

Station 16A.—In the massive sandstone of the Riverside formation the following fauna was obtained at the east end of the Edwardsville tunnel on the Air Line railroad:

Aviculopecten sp. r, *Conularia micronema* r, *Derbya keokuk* a, *Macrodon?* r, *Productus burlingtonensis* c, *Spirifer keokuk* a, *Syringothyris texta* c.

BEAR GRASS CREEK QUARRIES, NEAR LOUISVILLE.

Just east of Louisville the Niagara limestone is extensively quarried along the banks of Bear Grass creek. The tops of the hills in the vicinity of the quarries are usually capped with from ten to fifteen feet of the Jeffersonville limestone. The following section is exposed at the quarry south of the Institute for the Blind:

b. White to light grey limestone.................... 10 ft.

a. Light bluish grey arenaceous limestone........ 35 ft.

The beds of "a" of this section contain characteristic Niagara fossils.

In the upper ten feet Devonian fossils are abundant. *Spirifer gregarius* occurs in great profusion and with a few species of corals furnishes the greater part of the fossils in some of the strata.

The fossils identified from these beds are as follows:

Station 15A.—Bear Grass quarries.

Atrypa reticularis a, *Aviculopecten princeps*, *Chonetes mucronatus* r, *Conocardium trigonale* r, Crinoid stems c, *Orthis iowensis* c, *Pentamerella arata* r, *Phacops cristata* var. *pipa*, *Platyceras carinatum* r, *Platyceras dumosum* r, *Platyceras echinatum* r, *Pleurodic-*

tyon problematicum r, *Polypora* sp. c, *Proetus crassimarginatus* c, *Spirifer* sp. r, *Spirifer acuminatus* r, *Spirifer byrnesi* r, *Spirifer gregarius* a, *Spirifer iowensis*, *Spirifer raricostus ?* r, *Spirifer varicosus* r, *Streptorhynchus arctostriatus* r, *Stropheodonta demissa* c, *Stropheodonta hemispherica* r, *Stropheodonta perplana r*, *Terebratula lincklæni* r, *Zaphrentis* sp. c.

BROOKS SECTION.

A generalized section of the rocks in the vicinity of Brooks station, which is about fifteen miles south of Louisville, is as follows:

Massive sandstone	40-50 ft.
Sandy shale and sandstone	50-75 ft.
Blue clay shale	50-65 ft.
Black to chocolate colored shale	15-30 ft.
Devonian limestone	2 - 6 ft.
Niagara limestone and sandstone	15-20 ft.

The Black shale was found to rest unconformably on the Devonian limestone in the vicinity of Brooks. In the bed of Brooks run, between the railroad and the wagon road, the lower strata of the Black shale lie in shallow, irregularly eroded pockets in the limestone. In some of these a thin layer of reddish clay was observed between the limestone and the undisturbed Black shale. The unconformity observed here is shown in the accompanying figure (Fig. 1).

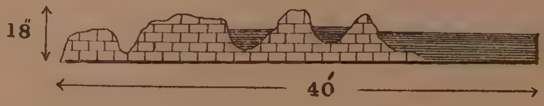

FIG. 1.—Section on Brooks Run, Bullitt County, Kentucky.

These Sellersburg beds are entirely wanting here.

The Devonian limestone of the above section probably does not exceed two feet in thickness. It afforded the following fossils:

Station 25A.—Brooks Run.

Actinopteria sp., *Atrypa reticularis* c, *Camarotœchia* sp., *Lichenalia* sp., *Orthis vanuxemi* r, *Pentamerella arata* r, *Phacops rana*, *Platyceras* sp., *Platyostoma lineatum* c, *Productella spinulicosta* r, *Proetus crassimarginatus* c, *Rhipidomella livia* r, *Spirifer divaricatus* r, *Spirifer fimbriatus* r, *Spirifer fornaculus* r, *Spirifer varicosus* r, *Stropheodonta demissa* r, *Stropheodonta perplana*.

The unconformity of the Black shale and the underlying limestones is well shown in a section exposed in the railroad cut a quarter of a mile south of Huber station. The shale on one side of the section here is separated from the limestone by about four inches of red clay.

The accompanying figure (Fig. 2) illustrates the relations observed between the shale and the limestone at this point.

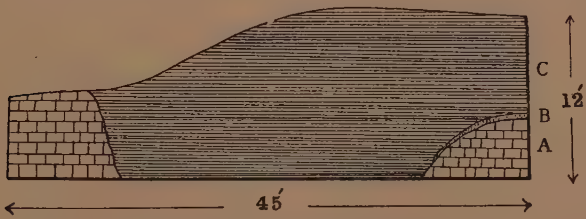

FIG. 2.—Section showing the unconformity of the Black shale and the Devonian limestone.

A. Devonian limestone.
B. Red clay.
C. Black shale.

The limestone just under the black shale in this section afforded the following species:

Station 26B.—Huber, Ky.

Ambocœlia umbonata a, *Camarotœchia tethys* c, *Orthis* sp., *Platyceras* sp., *Spirifer davisi?* r, *Spirifer fimbriatus* r, *Spirifer segmentus* r, *Spirifer varicosus* r, *Tropidoleptus carinatus* r.

The New Albany Black shale does not everywhere have the black color usually characteristic of it. At the side of the wagon road about three-quarters of a mile northeast of Brooks it has a pale buff color, and the following fossils were obtained from it at this locality:

Station 25B.—Brooks, Ky.

Chonetes scitulus, *Leiorhynchus quadricostata ?*, *Lingula spatulata* a.

Station 25C.—The New Providence shale is well exposed by extensive washes on the side of Button mould knob, about two miles north of Brooks. This has been a well-known collecting ground for many years and the rarer species are very scarce. The following were found here:

Athyris lamellosa ? r, *Aulopora* sp. a, *Camarotœchia* sp., *Chonetes illinoisensis* c, Crinoid stems a, *Orthothetes crenistria* r, *Platyceras* sp. a, *Productella pyxidata*, *Rhipidomella oweni* a, *Spirifer marionensis ?* c, *Spirifer mortonanus* r, *Spirifer suborbicularis* c, *Spiriferina* sp. c, *Strombodes striatus*, *Zaphrentis* sp. a.

The massive Riverside sandstone which caps this knob appears to be entirely barren of fossils. But in the beds of the same horizon the following fauna was found west of Brooks:

Station 25D.—Riverside sandstone one mile west of Brooks.

Camarotœchia sappho c, *Cypricardinia sp.* r, *Derbya keokuk* c, *Discina* sp. r, *Fenestella* sp. c, *Orthothetes crenistria* r, *Productus burlingtonensis* c, *Syringothyris typa* c.

DEER LICK KNOB, BULLITT COUNTY, KENTUCKY.

Northwest of Charmount, at Deer Lick knob, is the following section:

Blue clay shale	35 ft.
Thin bedded crinoidal limestone	5 ft.
Black shale	15 ft.
Devonian limestone	3 ft.

The thin limestone formation of this section at the top of the Black shale is of particular interest because it occupies the same stratigraphic horizon as the Rockford limestone thirty miles to the west and carries the typical New Providence shale fauna, which is entirely unlike that of the Rockford limestone. The following species were obtained from it:

Station 26D.—Deer Lick knob, Bullitt county, Kentucky.

Rhipidomella oweni a, *Spirifer mortonanus* c, *Spirifer suborbicularis* c.

The blue clay shale beds here have the usual characteristics of the New Providence shale, but contain very few fossils. None of these species occur in the Kinderhook fauna which occupies this horizon in southern Indiana.

LEBANON JUNCTION, KENTUCKY.

The New Providence shale is exposed on the sides of the knobs near Lebanon Junction and the following species were obtained:

Station 26D.—Northwest of Lebanon Junction one-half mile.

Athyris lamellosa a, *Chonetes illinoisensis r*, *Dielasma bovidens?* r, *Productus semireticulatus* c, *Spirifer* sp. r, *Spirifer marionensis* r, *Spirifer mortonanus* c, *Zaphrentis dalei* E. and H. a.

The absence, or at least the scarcity, of *Rhipidomella oweni* at this station is rather surprising, since it is usually the most abundant species in these beds.

NEW HAVEN, KENTUCKY.

The Devonian limestone was not seen at New Haven and if present there is very thin. The section below is exposed just west of the town on the bank of Rolling Fork.

Black shale	5 ft.
Covered	4 ft.
Dolomitic limestone	7 ft.

The Dolomitic limestone of the above section furnished the following Niagara species:

Station 27.—New Haven, Kentucky.

Calymene niagarensis c, *Dalmanites verrucosus* r.

About five miles south of New Haven the following section is exposed along the pike at Muldrow's hill:

Covered	10	ft.
Shelly limestone and shale	20	ft.
Shale	3-5	ft.
Limestone	20	ft.
Sandstone	9	ft.
Limestone	20	ft.
Sandstone	9	ft.
Limestone	18	ft.
Bluish sandstone weathering shelly	40	ft.
Blue shelly sandstone	15	ft.
Shelly sandstone and sale	15	ft.

The above section shows the interpolation of the Lower Carboniferous limestone beds in the Riverside sandstone.

The following section shows a similar interstratification of the limestone and sandstone beds.

Section two miles southwest of New Haven:

Shelly sandstone	8	ft.
Limestone	20	in.
Grey sandy shale	10	ft.
Limestone and shale	18	ft.
Covered (mostly shale?)	60	ft.
Blue clay shale	10	ft.
Iron ore concretions	4	in.
Black shale	10	ft.

No fossils were seen in the blue clay shale of the above section except Crinoid stems.

Riley's, Kentucky.

The Lower Silurian limestone outcrops about one hundred yards northwest of the station with a dip of 10°—15° toward the southwest. The Black shale is exposed in the cut at the station. A short distance northwest of this it was found resting unconformably on rocks which are probably of Niagara age, though no fossils were found by which to settle this point.

Station 28B.—Just south of the station in the sandy shales at the top of the hill the following species were collected about ninety feet above the Black shale:

Camarotœchia sappho r, *Chonetes illinoisensis* a, *Cypricardinia* sp. c, *Hemipronites crenistria* c, *Macrodon newarkensis?* r, *Palæoneilo bedfordensis r*, *Productus burlingtonensis* c, *Productus semireticulatus* c, *Productus shumardianus* a, *Productus punctatus* r, *Schizophoria* sp. r, *Spirifer* sp. r, *Spirifer marionensis* r, *Spirifer subelliptica* c, *Streblopteria* sp. r, *Syringothyris texta* r.

Parksville, Kentucky.

About three-quarters of a mile west of Parksville the Black shale rests directly on the Lower Silurian. The following Lower Silurian species were collected from the bluish shelly sandstone just below the Black shale:

Murchisonia sp. c, *Platystrophia crassa* r, *Platystrophia lynx* c.

The Black shale about Parksville is about twenty-five feet thick. No fossils were found in the blue clay shale above the Black shale here.

In the Riverside sandstone the following fauna was found about 125 feet above the Black shale:

Station 28B.—Old sandstone quarry one and one-half miles west of Parksville.

Camarotœchia sp. r, *Cryptonella eudora* c, *Eumentria* sp. r, *Hemipronites crenistria* c, *Platyceras lodense* r, *Productus alternatus* r, *Productus schumardanus* r, *Productus semireticulatus*, *Reticularia pseudolineata* c, *Spirifer keokuk* c, *Spirifer lateralis ?* r.

CRAB ORCHARD, KENTUCKY.

The Devonian limestone appears to be entirely absent in the vicinity of Crab Orchard. The following connected section includes the lowest beds observed in the vicinity of the springs and those outcropping in the knobs southwest of the town.

Section at Crab Orchard:

Shelly sandstone	50 ft.
Shelly crinoidal limestone	3-4 ft.
Shelly sandstone and clay shale (partly covered)	100 ft.
Black shale	35 ft.
Buff to brownish fine grained sandstone	10 ft.

No fossils were found in the fine grained sandstone below the Black shale.

The shelly sandstone of the Riverside formation furnished the following fauna:

Station 28B.—Two Tree knob, two miles southwest of Crab Orchard.

Athyris lamellosa c, *Camarotœchia contracta?* c, *Chonetes illinoisensis* c, *Conocardium pulchellum* c, *Cypricardinia* sp. c, *Edmondia* n. sp. r, *Loxonema* nov. sp. r, *Phæthonides* sp. r, *Platyceras* sp. r, *Platyceras hertzeri?* r, *Productus* sp., *Proetus auriculatus* r, *Ptychospira sexplicata?* r, *Reticularia pseudolineata* r, *Sphenotus* sp. r, *Spirifer mortonanus* c, *Spirifer suborbicularis* c, *Spiriferina subelliptica* c, *Syringothyris texta* c, *Zaphrentis* sp. r.

PART III.

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SYSTEMATIC LIST, SHOWING RANGE AND DISTRIBUTION OF SPECIES*.

	Jeffersonville limestone and Sellersburg beds.	New Albany shale.	Rockford limestone.	New Providence shale.	Riverside sandstone.
Protozoa.					
Mœllerina greenei Ulrich, Falls of the Ohio (E. O. Ulrich)	x	...	...	...	...
Palæacis enormis Meek and Worthen, Rockford, Ind. (Meek and Worthen)	...	...	x	...	...
Cœlenterata.					
Acervularia davidsoni E. and H., 11†, Jeffersonville (White)	x	...	...	...	...
*Acrophyllum oneidaense Billings, 12, Falls of the Ohio (W. J. Davis)	x	...	...	...	...
*Alveolites goldfussi Billings, 11, Louisville, Ky. (W. J. Davis)	x	...	...	...	...
*Alveolites indianensis Hall, 11, Louisville, Ky	x	..	...	...	...
Alveolites labiosus Billings, Falls of the Ohio (Rominger)	x	...	...	...	...
*Alveolites megastoma Winch., Falls of the Ohio (W. J. Davis)	x	...	...	...	...
Amplexus? rockfordensis M. and G., Rockford (Miller and Gurley)	...	...	x	...	...
*Amplexus yandelli Milne E., 11, Falls of the Ohio, Madison (Rominger) (Cornett)	x	...	...	...	...

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*Species preceded by a star are included in the published lists of fossils in the Indiana State Museum (16th Ann. Rept. Ind. Dept. Geol. and Nat. Res.). Species or localities included on the authority of others have been followed by the name of the authority in parenthesis.

†Numbers following the names of species refer to the Reports of the In-

The following Cœlenterates are from the Jeffersonville limestone and Sellersburg beds except when otherwise indicated:

*Astræospongia hamiltonensis M. and W.,
Clark county.

Aulacophyllum convergens Hall, 12,
Falls of the Ohio,
Clark county.

Aulacophyllum cruciforme Hall, 12,
Falls of the Ohio.

Aulacophyllum insigne,
Falls of the Ohio (W. J. Davis).

Aulacophyllum pinnatum Hall, 12,
Falls of the Ohio.

Aulacophyllum poculum Hall, 12,
Falls of the Ohio.

Aulacophyllum præciptum Hall, 12,
Falls of the Ohio.

Aulacophyllum princeps Hall, 12,
Falls of the Ohio.

Aulacophyllum prateriforme Hall, 12,
Falls of the Ohio.

Aulacophyllum reflexum Hall, 12,
Indiana.

*Aulacophyllum sulcatum d'Orb.,
Louisville, Ky. (W. J. Davis).

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diana Geological Survey which contain the authority for some of the localities cited. They have been numbered as follows:

1.	Geol.	Rept.	of	Ind.,	1837-38	11.	Geol,	Rept.	of	Ind.,	1881
2.	"	"	"	"	1859-60	12.	"	"	"	"	1882
3.	"	"	"	"	1869	13.	"	"	"	"	1883
4.	"	"	"	"	1872	14.	"	"	"	"	1884
5.	"	"	"	"	1873	15.	"	"	"	"	1885-86
6.	"	"	"	"	1874	16.	"	"	"	"	1888
7.	"	"	"	"	1875	17.	"	"	"	"	1891
8.	"	"	"	"	1876-78	18.	"	"	"	"	1893
9.	"	"	"	"	1879	19.	"	"	"	"	1894
10.	"	"	"	"	1880	20.	"	"	"	"	1895

Aulacophyllum tripinnatum Hall, 12,
Falls of the Ohio.

*Aulacophyllum trisulcatum Hall, 12,
Charlestown, and
Falls of the Ohio.

Aulopora cornuta,
Falls of the Ohio (W. J. Davis).

Aulopora edithana,
Falls of the Ohio (W. J. Davis).

Aulopora serpens Goldfuss,
Falls of the Ohio (W. J. Davis).

*Baryphyllum d'orbignyi E. and H.,
Charlestown.

*Blothrophyllum acuminatum? Hall,
Falls of the Ohio.

*Blothrophyllum approximatum Mich.,
Falls of the Ohio.

*Blothrophyllum decorticatum Billings, Rominger,
Falls of the Ohio (W. J. Davis).

*Blothrophyllum promissum Hall,
Falls of the Ohio.

Bucanophyllum gracile Ulrich,
Falls of the Ohio (Ulrich).

Calamophora goldfussi,
Jennings county (Rominger).

Calcisphæra lemoni Knowlton,
Falls of the Ohio (Knowlton).

Chætetes ponderosus,
Falls of the Ohio (Rominger),
Madison (Cornett).

*Chonophyllum magnificum Billings,
Charlestown landing,
Falls of the Ohio.

*Chonophyllum ponderosum Rominger,
Charlestown.

Cladopora alpenensis Rominger,
Falls of the Ohio (W. J. Davis).

*Cladopora aspera Rominger,
Falls of the Ohio.

Cladopora billingsi,
Louisville, Ky. (W. J. Davis).

*Cladopora cryptodens Bill.,
Falls of the Ohio.

*Cladopora expatiata Rominger,
Falls of the Ohio (W. J. Davis).

*Cladopora fischeri Billings,
Falls of the Ohio,
Charlestown landing (Rominger).

Cladopora francisci,
Falls of the Ohio (W. J. Davis).

*Cladopora imbricata Rominger,
Falls of the Ohio (Rominger), (Davis).

Cladopora iowensis,
Falls of the Ohio (W. J. Davis).

*Cladopora labiosa Billings,
Falls of the Ohio (W. J. Davis).

Cladopora lichenoides Rominger,
Falls of the Ohio (Rominger).

Cladopora linneana Rominger, 11,
Shelby county.

*Cladopora ornata Rominger,
Clark county.

Cladopora pinguis,
Falls of the Ohio (W. J. Davis).

Cladopora pulchra Rominger,
Falls of the Ohio (W. J. Davis).

Cladopora rimosa Rominger,
Falls of the Ohio (W. J. Davis).

*Cladopora robusta Rominger,
Falls of the Ohio (W. J. Davis), (Rominger).

Cladopora roemeri,
Louisville, Ky. (W. J. Davis).

*Clisiophyllum conigerum Rominger, 12,
Falls of the Ohio.

Clisiophyllum oneidaense Billings, 11. (See Acrophyllum oneidaense.)

*Cœnostroma monticulifera Winch. (Stromatopora monticulifera),
Falls of the Ohio.

*Coleophyllum pyriforme Hall, 12,
Falls of the Ohio (Hall).

*Crepidophyllum archiaci Bill.,
Falls of the Ohio.

*Cyathophyllum arctifossa Hall, 12,
Falls of the Ohio.

*Cyathophyllum brevicorne Rominger,
Falls of the Ohio (W. J. Davis).

Cyathophyllum cæspitosum Goldfuss,
Madison (Cornett).

Cyathophyllum colligatum,
Louisville, Ky. (W. J. Davis).

Cyathophyllum coralliferum,
Falls of the Ohio (W. J. Davis).

*Cyathophyllum corniculum Milne Ed., 11,
Falls of the Ohio (W. J. Davis).
Shelby county.

*Cyathophyllum davidsoni Milne E.,
Falls of the Ohio (W. J. Davis),
Shelby county.

Cyathophyllum depressum Hall,
Falls of the Ohio (Jas. Hall).

Cyathophyllum exiguum,
Falls of the Ohio (W. J. Davis).

*Cyathophyllum geniculatum Rominger,
Bartholomew county.

Cyathophyllum halli,
Falls of the Ohio (W. J. Davis).

*Cyathophyllum houghtoni Rominger,
Hartsville.

Cyathophyllum impositum Hall,
Falls of the Ohio (Jas. Hall).

*Cyathophyllum juvene Rominger,
Louisville, Ky. (W. J. Davis),
Shelby county.

Cyathophyllum radicula Rominger,
Charlestown (Rominger),
Louisville, Ky. (W. J. Davis).

*Cyathophyllum robustum,
Falls of the Ohio (W. J. Davis).

*Cyathophyllum rugosum Milne Edwd., 12,
Jennings county,
Falls of the Ohio (Rominger).
Jackson county, and
Madison.

*Cyathophyllum scyphus Rominger, 11,
Louisville, Ky. (W. J. Davis),
Shelby county.

*Cyathophyllum tornatum,
Louisville, Ky. (W. J. Davis).

*Cyathophyllum validum Hall,
Falls of the Ohio.

Cyathophyllum vesiculatum Hall,
Falls of the Ohio (Jas. Hall).

Cyclospongia discus Miller,
Bunker Hill.

*Cystiphyllum americanum E. and H.,
Clark county.

Cystiphyllum cuyagaensis,
Louisville, Ky. (W. J. Davis).

Cystiphyllum grande,
Falls of the Ohio (W. J. Davis).

Cystiphyllum greenei Miller, 18,
Falls of the Ohio.

Cystiphyllum pustulatum Hall,
Falls of the Ohio (Hall).

*Cystiphyllum squamosum,
Falls of the Ohio (W. G. Davis).

*Cystiphyllum sulcatum Billings, 11,
Falls of the Ohio (Rominger).

*Cystiphyllum vesiculosum Goldf., 11,
Falls of the Ohio (W. J. Davis).

Dendropora alterans,
Louisville, Ky. (W. J. Davis).

Dendropora neglecta,
Falls of the Ohio (Rominger),
Louisville, Ky. (W. J. Davis).

Dendropora proboscidialis,
Falls of the Ohio (W. J. Davis).

Diphyphyllum adnatum Hall, 12,
Falls of the Ohio.

*Diphyphyllum apertum Hall, 12,
Falls of the Ohio.

Diphyphyllum archiaci Bill., 11,
Louisville, Ky. (W. J. Davis),
Shelby county.

*Diphyphyllum colligatium,
Falls of the Ohio (Bill.).

Diphyphyllum gigas,
Falls of the Ohio (W. J. Davis).

Diphyphyllum simcœnse Billings, 11,
Falls of the Ohio (W. J. Davis).

*Diphyphyllum stramineum Billings, 12,
Falls of the Ohio.

Diphyphyllum strictum,
Falls of the Ohio (W. J. Davis and Nicholson).

Diphyphyllum panicum,
Louisville, Ky. (W. J. Davis).

Diphyphyllum tumidulum Hall, 12,
Falls of the Ohio.

Diphyphyllum verneuilanum,
Louisville, Ky. (W. J. Davis).

Drymopora intermedia,
Falls of the Ohio (W. J. Davis).

Drymopora nobilis,
Falls of the Ohio (W. J. Davis).

Emmonsia cylindrica, 8,
Madison (Cornett).

Emmonsia hemispherica Troost, 8,
Madison,
Carroll county (Cornett).

Eridophyllum arundinaceum. (See Diphyphyllum arundinaceum.)

*Eridophyllum strictum Edwards and Haine. (See Diphyphyllum simcoense.)

*Favosites canadensis Billings, 11,
Falls of the Ohio (W. J. Davis).
Shelby county.

*Favosites cavernosus Rominger,
Falls of the Ohio.

*Favosites clausus Rominger, 11,
Falls of the Ohio (Rominger), (Davis).

*Favosites digitatus Rominger,
Louisville, Ky. (W. J. Davis).

*Favosites emmonsi Rominger, 12,
Louisville,
Charlestown,
Falls of the Ohio (W. J. Davis).

*Favosites epidermatus Rominger, 11,
Falls of the Ohio,
Bartholomew county.

*Favosites fibrosus,
Madison (Cornett).

Favosites gothlandicus Lamark, 8,
Madison.

*Favosites hemisphericus Y. and S.,
Falls of the Ohio.

Favosites intertextus Rominger,
Falls of the Ohio (Davis).

*Favosites limitaris Rominger, 12,
Falls of the Ohio (Rominger).

Favosites maximus Troost,
Falls of the Ohio (Rominger).

*Favosites placenta Rominger,
Falls of the Ohio (Davis).

*Favosites pleurodictyoides Nicholson,
Charlestown.

Favosites polymorpha Goldfuss, 11,
Madison.

*Favosites radiatus Rominger,
Falls of the Ohio.

*Favosites radiciformis Rominger,
Falls of the Ohio (Davis).

Favosites ramosus, 8,
Madison.

*Favosites tuberosus Rominger,
Charlestown,
Falls of the Ohio (Rominger).

*Favosites turbinatus Billings,
Falls of the Ohio.

Favosites winchelli Rominger,
Falls of the Ohio (Rominger).

*Fistulipora acervulosa Rominger,
Falls of the Ohio.

Fistulipora canadensis Billings, 11,
(Rominger).

Fistulipora intercellata Hall,
Falls of the Ohio (Hall).

Glossotrypa paliformis Hall,
Falls of the Ohio (Hall).

*Hadrophyllum d'orbignyi,
Louisville, Ky.,
Clark county (W. J. Davis).

Heliolites pyriformis Guettard,
Louisville, Ky. (W. J. Davis).

Heliolites subtubulatus McCoy,
Louisville, Ky. (W. J. Davis).

Heliophyllum annulatum Hall, 12,
Scott county, and
Clark county.

Heliophyllum compactum Hall, 12,
Falls of the Ohio,

Heliophyllum corniculum Hall, 12,
Falls of the Ohio.

Heliophyllum denticulatum Hall, 12,
Falls of the Ohio.

Heliophyllum distans Hall, 12,
Falls of the Ohio.

Heliophyllum equum Hall, 12,
Falls of the Ohio.

*Heliophyllum exiguum Billings, 11,
Falls of the Ohio,
Shelby county.

Heliophyllum fecundum Hall, 12,
Falls of the Ohio.

*Heliophyllum gemmatum Hall, 12,
Falls of the Ohio.

*Heliophyllum gemmiferum Hall,
Falls of the Ohio.

*Heliophyllum halli E. and H., 12,
Falls of the Ohio.

Heliophyllum incrassatum Hall, 12,
Falls of the Ohio.

Heliophyllum invaginatum Hall, 12,
Falls of the Ohio.

Heliophyllum latericrescens Hall, 12,
Falls of the Ohio.

Heliophyllum nettlerothi Hall, 12,
Falls of the Ohio.

Heliophyllum sordidum Hall, 12,
Falls of the Ohio.

*Heliophyllum parvum Hall, 12,
Falls of the Ohio.

*Heliophyllum scyphulus Hall, 12,
Charlestown.

*Heliophyllum tenuimurale Hall, 12,
Falls of the Ohio.

Hydrophyllum orbignyi, 8,
Madison.

Intrepora preteolata Hall,
Falls of the Ohio (Hall).

Lichenalia alternata Hall,
Falls of the Ohio.

Lichenalia (Odontotrypa) alveata Hall,
Falls of the Ohio (Hall.).

Lichenalia bistriata Hall,
Falls of the Ohio.

Lichenalia (Selenopora) circincta Hall,
Falls of the Ohio (Hall).

Lichenalia (Selenopora) complexa Hall,
Falls of the Ohio (Hall).

Lichenalia conulata Hall,
Falls of the Ohio (Hall),

Lichenalia geometrica Hall,
Falls of the Ohio (Hall).

Lichenalia ovata Hall,
Falls of the Ohio (Jas. Hall).

Lichenalia (Pileotrypa) pyrisormis Hall,
Falls of the Ohio (Hall).

Lichenalia subcava Hall,
Falls of the Ohio (Hall).

Lichenalia substellata Hall,
Falls of the Ohio (Jas. Hall).

*Michelinia clappi (Milne E.) Rominger,
Falls of the Ohio (Rominger).

*Michelinia convexa,
Falls of the Ohio (d'Orbigne).

*Michelinia cylindrica E. and H.,
Falls of the Ohio (Davis).

*Michelinia favositoidea Billings,
Falls of the Ohio (Davis).

*Michelinia insignis Rominger,
Falls of the Ohio (Rominger).

*Phillipsastrea gigas,
Charlestown,

*Phillipsastrea verneuilli Milne Edw.,
Madison (Cornett).

*Phillipsastrea yandelli Rominger,
Charlestown.
Falls of the Ohio (Rominger).

Prismopora triquetra Hall,
Falls of the Ohio (Hall).

Receptaculites elrodi Miller, 18,
Hartsville.

Romingeria umbellifera,
Falls of the Ohio (W. J. Davis).

Streptelasma coarctatum Hall, 12,
Louisville, Ky.

Streptelasma inflatum Hall, 12,
Falls of the Ohio.

Streptelasma mammiferum Hall, 12,
Falls of the Ohio.

Streptelasma papillatum Hall, 12,
Falls of the Ohio.

Streptelasma simplex Hall, 12,
Falls of the Ohio.

Streptelasma tenue Hall, 12,
Falls of the Ohio.

*Striatopora cavernosa Rominger,
Falls of the Ohio (Rominger).

Striatopora huronensis Rominger,
Falls of the Ohio (Davis).

Striatopora linneana Billings, 11,
Falls of the Ohio (Rominger).

*Stromatopora concentrica Goldfuss,
Madison (Cornett).

*Stromatopora constellata Hall,
Falls of the Ohio.

*Stromatopora densum Nich., 12,
Charlestown,

*Stromatopora granulata Nich.,
Falls of the Ohio,

*Stromatopora mammillata Nich.,
Clark county.

*Stromatopora nodulata Nich.,
Shelby county,
Clark county.

*Stromatopora substriatella Nich.,
Falls of the Ohio.

Syringopora bouchardi,
Falls of the Ohio (W. J. Davis).

*Syringopora hisingeri Billings,
Falls of the Ohio (Rominger).

*Syringopora malcurii Billings, 11,
Falls of the Ohio.

*Syringopora perelegans Billings, 11 and 12,
Falls of the Ohio (W. J. Davis).

*Syringopora tabulata E. and H.,
Madison, and
Falls of the Ohio (Rominger).

*Syringopora tubiporoides Y. and S.,
Madison (Cornett),
Falls of the Ohio (W. J. Davis).

*Thecia ramosa Rominger,
Falls of the Ohio (Rominger).

Zaphrentis compressa Rominger, 12,
Falls of the Ohio (W. J. Davis).

Zaphrentis concava Hall, 12,
Falls of the Ohio.

Zaphrentis conigera Rominger, 11,
Falls of the Ohio (Rominger).

*Zaphrentis convoluta Hall, 12,
Falls of the Ohio.

*Zaphrentis cornicula Leseur,
Falls of the Ohio.
Charlestown (Rominger),
Madison.

Zaphrentis (Amplexus) cruciforme Hall, 12,
Falls of the Ohio.

Zaphrentis cyathiformis Hall, 12,
Falls of the Ohio.

*Zaphrentis dalei E. and H. - - **New Providence Shale.**
Harrison county (Collett).

*Zaphrentis davisana Miller,
Falls of the Ohio.

Zaphrentis deformis Hall, 12,
Charlestown.

*Zaphrentis duplicata Hall, 12,
Falls of the Ohio.

*Zaphrentis elegans Hall, 12,
Falls of the Ohio.

*Zaphrentis exiguum Billings,
Falls of the Ohio.

*Zaphrentis foliata Hall, 12,
Falls of the Ohio.

*Zaphrentis gigantea Rafinesque, 11,
Madison,
Jennings county,
Falls of the Ohio (Rominger).

*Zaphrentis herzeri Hall, 12,
Charlestown.

Zaphrentis ida Win. - - - - - **Rockford limestone.**
Rockford (Winchell).

*Zaphrentis nitida Hall, 12,
Falls of the Ohio.

Zaphrentis nodulosa Rominger,
Falls of the Ohio (W. J. Davis).

Zaphrentis ovalis Hall, 12,
Falls of the Ohio.

Zaphrentis planima Hall, 12,
Falls of the Ohio.

Zaphrentis ponderosa Hall, 12,
Falls of the Ohio,

*Zaphrentis profunda Hall, 12,
Falls of the Ohio.

*Zaphrentis prolifica Billings,
Louisville, Ky. (W. J. Davis).

*Zaphrentis rafinesquei E. and H., 11,
Falls of the Ohio,
Jennings county,
Madison (W. J. Davis).

Zaphrentis subcompressa Hall, 12,
Falls of the Ohio.

Zaphrentis spira Hall, 12,
Falls of the Ohio.

Zaphrentis terebrata Hall, 12,
Falls of the Ohio.

Zaphrentis torta Hall, 12,
Falls of the Ohio, and
Clark county.

Zaphrentis trisutura Hall, 12,
Falls of the Ohio.

*Zaphrentis ungula Rominger, 12,
Falls of the Ohio (Rominger).

*Zaphrentis yandelli E. and H.,
Falls of the Ohio (W. J. Davis).

Echinodermata.

The following Echinoderms are from the Jeffersonville limestone and Sellersburg beds except when otherwise indicated:

Actinocrinus coreyi Lyon and Casseday,
Washington county (L. and C.)

*Ancyrocrinus bulbosus Hall,
Falls of the Ohio.

Ancyrocrinus spinosus Hall,
Clark county.

Barycrinus sculptilis Hall (Cyathocrinus sculptilis),
Clark county.

*Catillocrinus bradleyi M. and W., 8 - **Riverside sandstone.**
Harrison county.

Codaster americanus Shumard,
Falls of the Ohio (Shumard).

Codaster attenuatus Lyon,
Falls of the Ohio (Lyon).

Codaster pyramidatus Shumard,
Falls of the Ohio (Shumard).

Dolatocrinus amplus Miller and Gurley,
Charlestown (M. and G.).

Dolatocrinus aplatus M. and G.,
Charlestown (M. and G.).

Dolatocrinus approximatus M. and G.,
Louisville, Ky. (M. and G.).

Dolatocrinus argutus M. and G.,
Charlestown (M. and G.).

Dolatocrinus bellulus M. and G.,
Charlestown (M. and G.).

Dolatocrinus bellarugosus M. and G.,
Charlestown (M. and G.).

Dolatocrinus bulbaceus M. and G.,
Charlestown (M. and G.).

Dolatocrinus cælatus M. and G.,
Charlestown (M. and G.).

Dolatocrinus charlestownensis M. and G.,
Charlestown (M. and G.).

Dolatocrinus corporosus M. and G.,
Charlestown (M. and G.).

Dolatocrinus exornatus M. and G.,
Charlestown (M. and G.).

Dolatocrinus grandis M. and G.,
Louisville, Ky. (M. and G.).

Dolatocrinus greenei M. and G.,
Louisville, Ky. (M. and G.).

Dolatocrinus indianensis M. and G.,
Charlestown (M. and G.)

Dolatocrinus lacus Lyon,
Falls of the Ohio, and
Silver Creek, Clark county (Lyon).

Dolatocrinus lineolatus M. and G.,
Charlestown (M. and G.).

Dolatocrinus magnificus M. and G.,
Falls of the Ohio (M. and G.).

Dolatocrinus marshi Lyon,
Falls of the Ohio, and
Charlestown.

Dolatocrinus neglectus M. and G.,
Charlestown (M. and G.).

Dolatocrinus nodosus M. and G.,
Charlestown (M. and G.).

Dolatocrinus ornatus var. asperatus M. and G.,
Charlestown (M. and G.).

Dolatocrinus pulchellus M. and G.,
Charlestown (M. and G.).

Dolatocrinus sacculus M. and G.,
Charlestown (M. and G.).

Dolatocrinus salebrosus M. and G.,
Charlestown (M. and G.).

Dolatocrinus spinosus M. and G.,
Charlestown (M. and G.).

Dolatocrinus stellifer M. and G.,
Louisville, Ky. (M. and G.).

Eleutherocrinus cassedayi Y. and S.,
Clark county.

Eretmocrinus originarius Wach. and Spr.,
Bono (Wach. and Springer).

Gennæocrinus cornigerus L. and C. (Actinocrinus kentuckensis),
Clark county.

Gilbertsocrinus greenei M. and G.,
Charlestown (M. and G.).

Gilbertsocrinus indianensis M. and G.,
Charlestown (M. and G.).

Ichtyocrinus spinosulus M. and G.,
Clark county (M. and G.).

Megistocrinus abnormis Lyon (Actinocrinus abnormis),
Clark county, and
Falls of the Ohio (Lyon).

Megistocrinus expansus M. and G.,
Louisville, Ky. (M. and G.).

Megistocrinus hemisphericus M. and G.,
Clark county (M. and G.).

Megistocrinus knappi Lyon and Cassady,
Falls of the Ohio (Lyon).

Megistocrinus ornatus M. and G.,
Clark county (M. and G.).

Megistocrinus rugosus L. and C.,
Clark county,
Falls of the Ohio.

Megistocrinus spinulosus Lyon,
Falls of the Ohio (Lyon).

Nucleocrinus angularis Lyon (Olivanites angularis),
Falls of the Ohio.

Nucleocrinus greenei M. and G.,
Louisville, Ky. (M. and G.).

*Nucleocrinus verneuili Troost (Olivanites verneuili),
Falls of the Ohio.

Nucleocrinus venustus M. and G.,
Louisville, Ky. (M. and G.).

*Platycrinus leai Lyon,
Jeffersonville.

Poteriocrinus davisanus Miller,
Deputy (Miller).

Poteriocrinus nettlerothanus Miller,
Deputy (Miller).

Sabatocrinus swallovi Hall, 8,
Harrison county.

Synbathocrinus oweni Hall, - - - **Rockford limestone.**
Rockford (Jas. Hall).

Vasocrinus sculptus Lyon,
Falls of the Ohio (Lyon).

Vermes.

The following worm is from the Jeffersonville limestone and Sellersburg beds:

Conulites elevata Cozzens,
(Cozzens).

Molluscoidea.

BRYOZOA.

The following Bryozoa are from the Jeffersonville limestone and Sellersburg beds except when otherwise indicated:

Buscopora lunata Rominger (Buscopora dentata) Ulrich,
Falls of the Ohio (Ulrich).

Cosinatrypa cribriformis var. carinata Hall,
Falls of the Ohio (Hall).

Cystopora geniculata Hall,
Falls of the Ohio (Hall).

Discotrypa devonica Ulrich,
Falls of the Ohio (Ulrich).

Eridopora minima Ulrich,
Falls of the Ohio (Ulrich).

Fenestella (Unitrypa) acaulis Hall. (See Unitrypa acaulis.)

Fenestella (Polypora) aculeata Hall,
Falls of the Ohio (Hall).

Fenestella bifurca Ulrich,
Falls of the Ohio (A. E. Ulrich).

Fenestella bigeneris Ulrich,
Falls of the Ohio "

Fenestella imbricata Hall,
Falls of the Ohio (Hall).

Fenestella biserrulata Hall,
Falls of the Ohio "

Fenestella confertipora Hall,
Falls of the Ohio "

Fenestella (Hemitrypa) cribrosa Hall,
Falls of the Ohio "

Fenestella cultrata Hall,
Falls of the Ohio "

Fenestella curvijunctura Hall,
Falls of the Ohio "

Fenestella depressa Hall,
Falls of the Ohio "

Fenestella equalis Hall,
Falls of the Ohio "

Fenestella interrupta Hall,
Falls of the Ohio "

Fenestella latijunctura Hall,
Falls of the Ohio "

Fenestella lunulata Hall,
Falls of the Ohio. "

Fenestella patellifera Ulrich,
Falls of the Ohio (A. E. Ulrich).

Fenestella perplexa Hall,
Falls of the Ohio (Hall).

Fenestella permarginata Hall,
Falls of the Ohio (Hall).

Fenestella pertenuis Hall, 11,
Falls of the Ohio.

Fenestella plumosa Prout. (See Hemitrypa plumosa.)

Fenestella (Unitrypa) projecta Hall,
Falls of the Ohio (Hall).

Fenestella pulchella Ulrich,
Falls of the Ohio (A. E. Ulrich).

Fenestella (Polypora) quadrangularis Hall,
Falls of the Ohio (Hall).

Fenestella sculptilis Ulrich,
Falls of the Ohio (A. E. Ulrich).

Fenestella semirotunda Hall,
Falls of the Ohio (Hall).

Fenestella serrata Hall,
Falls of the Ohio "

Fenestella singularitas Hall,
Falls of the Ohio "

Fenestella stellata Hall,
Falls of the Ohio "

Fenestella tenella Hall,
Falls of the Ohio "

Fenestella (Unitrypa) transversa Hall,
Falls of the Ohio "

Fenestella variapora Hall,
Falls of the Ohio "

Fenestella verrucosa Hall,
Falls of the Ohio "

Fistulipora normalis Ulrich,
Falls of the Ohio (Ulrich).

Hiderella canadensis Hall,
Falls of the Ohio (Hall).

Lichenotrypa cavernosa Ulrich,
Falls of the Ohio (Ulrich).

Orthopora rhombifera Hall (Trematopora (Orthopora) rhombifera),
Falls of the Ohio.

Phractopora cristata Hall,
Falls of the Ohio (Hall).

Phractopora cristata var. lineata Hall,
Falls of the Ohio.

Pileotrypa clivulata Hall,
Falls of the Ohio (Hall).

Pileotrypa denticulata Hall,
Falls of the Ohio.

Polypora adnata Hall (Fenestella (Polypora) adnata),
Falls of the Ohio.

Polypora blandida Ulrich,
Falls of the Ohio (Ulrich).

Polypora celsipora var. minima Hall (Fenestella celsipora var. minima),
Falls of the Ohio (Hall).

Polypora quadrangularis Hall (Fenestella (Polypora) quadrangularis),
Falls of the Ohio (Hall).

Polypora transversa Ulrich,
Falls of the Ohio (A. E. Ulrich).

Scalaripora scalariformis Hall,
Falls of the Ohio (Hall).

Scalaripora subconcava Hall,
Falls of the Ohio.

Semicoscinium infraporosa Ulrich,
Falls of the Ohio (A. E. Ulrich).

Semicoscinium obliquatam Ulrich,
Falls of the Ohio (A. E. Ulrich).

Semicoscinium rhomboideum Prout,
Falls of the Ohio (Prout).

Semicoscinium tuberculatum Prout,
Falls of the Ohio "

184

Stictopora gilberti (Meek) Ulrich,
Falls of the Ohio.

Stictopora ovatipora Hall,
Falls of the Ohio.

Stictopora vermicula Hall,
Falls of the Ohio (Hall).

Trematella annulata (Trematopora (Trematella) annulata),
Falls of the Ohio (Hall).

Trematopora (Trematella) arborea "
Falls of the Ohio "

Trematopora hirsuta Hall,
Clark county.

Trematopora (Orthopora) regularis "
Falls of the Ohio "

Unitrypa acaulis (Fenestella (Unitrypa) acaulis)
Falls of the Ohio (Hall).

U nitrypa conferta Ulrich,
Falls of the Ohio (A. E. Ulrich).

Unitrypa fastigata Hall (Fenestella (Unitrypa) fastigata),
Falls of the Ohio (Hall).

Unitrypa retrorsa Ulrich,
Falls of the Ohio (A. E. Ulrich).

Unitrypa stipata Hall (Fenestella (U.) stipata),
Falls of the Ohio (Hall).

Unitrypa tegulata Hall (Fenestella (U.) tegulata),
Falls of the Ohio (Hall).

Brachiopoda.	Jeffersonville limestone and Sellersburg beds.	New Albany shale.	Rockford limestone.	New Providence shale.	Riverside sandstone.
*Athyris fultonensis (Swallow) Falls of the Ohio Charlestown landing (Nettleroth), Watson, Kent, Charlestown, Sellersburg, Lexington, Ind.	x	.	.	.	.
Ambocœlia gregaria Hall Common at Crothersville and Guinea Knobs, Ind.	.	.	x	.	.
*Ambocœlia umbonata Con. Abundant at Huber, Ky., Louisville (Nettleroth).	x	.	.	.	.
Athyris incrassata Hall? One or two specimens from Bartel, Ind., are referred to this species.	.	.	.	.	x
Athyris lamellosa (L'Eveillé) Common in New Provldence shale at Pixley Knob, Ind., and Lebanon Junction, Ky. Occurs in the Riverside sandstone at Crab Orchard, Ky.	.	.	.	x	.
*Athyris spiriferoides Eaton Utica, Clark county, and Charlestown (Hall), Huber, Ky.	x	.	.	.	.
Atrypa ellipsoidea Nettleroth Falls of the Ohio (Nettleroth.	x	.	.	.	.
*Atrypa reticularis Linn. Abundant at Lexington, Utica, Clark county, Falls of the Ohio, Charlestown (Hall), Sellersburg, Watson, Ind., Bear Grass creek, Louisville, Ky., Lancaster, Paris Crossing, Kent, Brooks, Ky.	x	.	.	.	.

*Atrypa spinosa Hall Rare at Falls of the Ohio, Charlestown, Clark county (Nettleroth).	x	.	.	.	.
Barriosella subspatulata (Meek and Worthen) Rockford, Ind. (Hall and Clark).	.	x	.	.	.
Camarotœchia carolina Hall Falls of the Ohio (Hall and Clark).	x	.	.	.	.
Camarotœchia congregata (Conrad) Falls of the Ohio (Hall), Watson, Ind., Lexington.	x	.	.	.	.
Camarotœchia sappho Hall Common throughout the region.	.	.	.	.	x
*Camarotœchia tethys (Bill.) Common at Falls of the Ohio, Lancaster, Kent, Watson, Bear Grass creek, Louisville, Scipio, Sellersburg, Lexington, Paris Crossing, Ind., Huber, Ky.	x	.	.	.	.
Chonetes acutiradiatus Hall Falls of the Ohio, Utica, and Clark county (James Hall), (Nettleroth).	x	.	.	.	.
Chonetes arcuatus Hall Common at Paris Crossing, Ind.	x	.	.	.	.
Chonetes coronatus Rare. Scott county, New Albany (Borden), Lexington, Ind.	x	.	.	.	.
Chonetes geniculatus White ? Abundant at Crothersville and Guinea Knobs, Ind.	.	.	x	.	.
Chonetes illinoisensis Worthen Common at Bartel and Pixley Knob, Ind., and Brooks, Lebanon Junction, Riley's, and Crab Orchard, Ky.	.	.	.	x	x
*Chonetes lepidus Hall New Albany, Scott county, Lexington, and Jennings county, Ind. (Whitfield).	.	x	.	.	.

Chonetes logani Norwood and Pratton…… Harrison county, 8. Common at Low Gap ridge, Crothersville, and Pixtey knob, Ind.	.	.	x?	x	x
Chonetes nana de Verneuil ……………… Falls of the Ohio (Norwood and Pratton).	x	.	.	.	.
Chonetes mucronatus Hall……………… Rare. Charlestown, Falls of the Ohio, Sellersburg, Ind., Bear Grass creek, Louisville, Ky.	x	.	.	.	.
*Chonetes planumbonus M. and W……… Clark county, Washington, and Harrison counties, 8.	.	.	.	.	x
Chonetes pusillus Hall………………………… Rare. Paris crossing.	x	.	.	.	.
*Chonetes scitulus Hall…………………… Brooks, Ky.	.	x	.	.	.
*Chonetes subquadrata Nettleroth………… Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Chonetes yandellanus Hall……………… Common. Lexington, Charlestown, Sellersburg, Falls of the Ohio, and Scipio, Ind.	x	.	.	.	.
*Conchidium knighti Nettleroth…………… Clark county (Nettleroth).	x	.	.	.	.
Cranæna romingeri Hall…………………… Clark county (Nettleroth).	x	.	.	.	.
Crania greenei Miller……………………… Falls of the Ohio, 18.	x	.	.	.	.
Crania sheldoni White……………………… Watson, Ind. (Nettleroth).	x	.	.	.	.
Cryptonella? eudora Hall…………………… A rather rare species in the sandstone at Brownstown and Low Gap Ridge, Ind., and Parksville, Ky.	.	.	.	.	x
Cryptonella? inconstans…………………… Rare. Guinea Knobs, Ind.	.	.	x	.	.

Cryptonella lens Hall Clark county (Hall and Whitfield).	x	.	.	.	.
Cryptonella ovalis Miller Rare. Bunker Hill, 17, Falls of the Ohio.	x	.	.	.	.
*Cyclorhina nobilis Hall Charlestown.	x	.	.	.	.
Cyrtina sp An undetermined species occurs in the shale at Pixley Knob, Ind.	.	.	.	x	.
Cyrtina crassa Hall Falls of the Ohio, Utica, Ind. (Nettleroth), (Hall).	x	.	.	.	.
*Cyrtina hamiltonensis Hall (Nettleroth) Clark county. Rare. Falls of the Ohio, Scipio, Paris creek, Sellersburg, Kent, Ind.	x	.	.	.	.
Cyrtina hamiltoniæ var. recta Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Delthyris consobrina (d'Orbigny) Falls of the Ohio and Charlestown, Ind.	x	.	.	.	.
*Delthyris raricosta Conrad Falls of the Ohio (Hall).	x	.	.	.	.
Delthyris sculptilis Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Derbya keokuk Hall Abundant in many localities. Brownstown, Edwardsville, Low Gap Ridge, Ind., Brooks, and Crab Orchard, Ky.	.	.	.	x	.
Deilasma bovidens (Norton)? A specimen from Lebanon Junction is doubtfully referred to this species.	.	.	x	.	.
Eunella harmonia Hall Falls of the Ohio (Hall).	x	.	.	.	.
*Eunella lincklæni Hall Falls of the Ohio (Nettleroth), Bear Grass creek, Louisville.	x	.	.	.	.

Eumetria marcyi (Shumard).................. This St. Louis species has been found in a single locality—Parksville, Ky.	.	.	.	.	x
Glossina triangulata (Nettleroth)............ Falls of the Ohio (Nettleroth).	x	.	.	.	.
Leiorhynchus greeneanum (Ulrich)......... New Albany, Knobstone (Ulrich).	.	x	.	.	.
*Leiorhynchus limitare (Vanuxem)......... Scott county.	.	x	.	.	.
*Leiorhynchus quadricostatum (Vanuxem) Rare. Harrison county, New Albany, Jennings county, Scott county (Whitfield) (Nettleroth), Crothersville?, Falls of the Ohio, Brooks?, Ky.	x	x	x?	.	.
*Leptæna rhomboidalis (Wilckens)......... Common. Sellersburg, Ind.	x	.	.	.	.
Lingulodiscina sp............................... An undetermined species occurs rarely at Low Gap Ridge.	.	.	.	.	x
Lingulodiscina newberryi (Hall)............ Rare. Brownstown, Ind.	.	.	.	.	x
Lingula ligea Hall............................... A Lingula which appears to belong to this species occurs abundantly at Crothersville, Ind.	.	x	.	.	.
Lingula melie Hall?............................. Lebanon, Ky. (Whitfield).	.	x	.	.	.
*Lingula spatulata Vanuxem.................. Jennings county and New Albany, Lebanon, Ky. (Whitfield), Louisville, Ky.	.	x	.	.	.
*Meristella haskinsi Hall....................... Charlestown.	x	.	.	.	.
*Meristella nasuta Conrad..................... Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Orbiculoidea ampla Hall....................... Rare. Charlestown and Watson, Ind. (Nettleroth).	x	.	.	.	.

Orbiculoidea doria (Hall) Clark county (Nettleroth).	x	.	.	.	.
Orbiculoidea minuta (Hall)? Lebanon, Ky.	.	x	.	.	.
*Orbiculoidea seneca (Hall) Charlestown.	x	.	.	.	.
Orthothetes chemungensis arctostriatus Hall Rare. Falls of the Ohio, Lancaster, Scipio, Kent, Bear Grass creek, Louisville.	x	.	.	.	.
*Orthothetes crenistria (Phillips?) Rather common. Low Gap Ridge, Bartel, Borden, Ind., Brooks, Riley's, and Parksville, Ky.	.	.	.	x	x
*Orthothetes umbraculum Hall and Clark New Providence, Ind., 12.	.	.	.	.	x
Parazyga hirsuta Hall Bunker Hill, 17, Falls of the Ohio (Nettleroth).	x	.	.	.	.
Pentamerella arata (Con.) Rare. Clark county, Falls of the Ohio (Hall).	x	.	.	.	.
Pentamerella pavilionensis Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Pentamerella thusnelda Nettleroth Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Pentagonia unisulcata (Con.) Falls of the Ohio (Nettleroth).	x	.	.	.	.
Pholidostrophia iowensis Owen Falls of the Ohio (Nettleroth).	x	.	.	.	.
Productus alternatus N. and P. Rare. Parksville, Ky.	.	.	.	.	x
Productus arcuatus Hall? A common species at Pixley Knob, Ind.	.	.	.	x	.
Productus burlingtonensis Hall Common. Brooks and Riley's, Ky.	.	.	.	.	x

Productus gracilis A. Winch A rare species at Pixley Knob and Borden, Ind.	.	.	.	x	x
Productus magnus Meek and Worthen "Knobstone," Harrison county (Collett).	.	.	.	.	.
Productus newberryi Hall. Common at Borden, Low Gap ridge, Bartel, and New Albany, Ind.	.	.	.	.	x
Productus punctatus (Martin) Several specimens of this Coal Measure species were found in the Waverly fauna at Riley's, Ky.	.	.	.	.	x
Productus pyxidata Hall A rather rare species at Pixley Knob, Ind., and Brooks, Ky.	.	.	.	.	x
*Productus semireticulatus (Martin) Common. Low Gap Ridge, Borden, Bartel, and Pixley Knob, Ind., Lebanon Junction, Riley's, and Parksville, Ky.	.	.	.	x	x
Productella semiglobosa Nettleroth. Falls of the Ohio (Nettleroth).	x	.	.	.	.
Productella shumardana Hall? Pixley Knob, Ind., Riley's and Parksville, Ky.	.	.	.	x	x
Productella spinulicosta Hall Falls of the Ohio, North Vernon, Paris Crossing.	x	.	.	.	.
*Productella spinulicosta Hall Rare. Charlestown, Shelby county, and Louisville (Hall and Clark), Kent, Bear Grass creek, Louisville, Ky., North Vernon, Ind.	x	.	.	.	.
*Productella subalata Hall Falls of the Ohio.	x	.	.	.	.
Ptychospira sexplicata (White and Whitf.)? A fossil doubtfully referred to this species occurs rarely at Bartel, Ind., Brooks, and Crab Orchard, Ky.	.	.	.	x	x

Reticularia pseudolineata (Hall)............. Common. Low Gap Ridge, Bartel, and Brownstown, Ind., Parksville and Crab Orchard, Ky.	.	.	.	.	x
Reticularia cooperensis (Swallow)........... Rockford (Jas. Hall).	.	.	x	.	.
Reticularia tenuispinata (Her.)............... One specimen from Bartel, Ind., is referred to this species.	.	.	.	.	x
*Rhipidomella burlingtonensis Hall......... "Knobstone," New Providence, Ind.	.	.	.	.	.
Rhipidomella goodwini (Nettleroth)......... Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Rhipidomella leucosia Hall................... Charlestown.	x	.	.	.	.
*Rhipidomella livia.............................. Rare. Clark county (Nettleroth), Bear Grass creek, Louisville, Falls of the Ohio, Brooks, Ky.	x	.	.	.	.
Rhipidomella ocassus Hall?................... Rockford (Hall), Crothersville, Ind.	.	.	x	.	.
Rhipidomella oweni Hall and Clark......... An abundant and characteristic fossil of the New Providence shale. Brooks and Clearmont, Ky.	.	.	.	x	.
*Rhipidomella vanxuemi Hall................. Clark county (Hall), Lexington, Ind., Brooks, Ky.	x	.	.	.	.
*Rhynchonella macra Hall..................... Washington county, Knobstone, 12.	.	.	.	.	.
Rhynchonella louisvillensis Nettleroth...... Falls of the Ohio (Nettleroth).	x	.	.	.	.
Rhynchonella obsolescens Hall.............. Rockford (Hall), and Crothersville, Ind.	.	.	x	.	.
Rhynchonella tenuistriata Nettleroth........ (Nettleroth).	x	.	.	.	.

*Schizophoria striatula (Scholtheim) Common. Lexington, Paris Crossing, Lancaster, Sellersburg, Ind., Falls of the Ohio, Bear Grass creek, Louisville.	x	.	.	.	.
Schizolobus concentrica (Vanuxem) Falls of the Ohio (Hall).	.	x	.	.	.
*Spirifer acuminatus Conrad, 10 Abundant. Falls of the Ohio (Hall), and Mount Vernon, Charlestown, Scipio, Lancaster, Kent, Falls of the Ohio, Bear Grass creek, Louisville, Lexington, North Vernon, Ind.	x	.	.	.	.
*Spirifer angustus Hall Charlestown, and Shelby county, 11.	x	.	.	.	.
*Spirifer arctisegmentus Hall Rare. Clark county (Nettleroth), Kent, Ind., Brooks, Ky.	x	.	.	.	.
Spirifer byrnesi Nettleroth Abundant. Clark county (Nettleroth), Lexington, Falls of the Ohio, Charlestown, Watson, Bear Grass creek, Louisville, Paris Crossing, Sellersburg, Ind.	x	.	.	.	.
Spirifer audaculus (Conrad) Louisville (Hall).	x	.	.	.	.
Spirifer davisi Nettleroth Rare. Falls of the Ohio (Nettleroth), Lancaster, Ind.	x	.	.	.	.
*Spirifer divaricatus Hall Rare. Clark county and Bunker Hill (Nettleroth), Brooks, Bear Grass creek, Louisville, Ky.	x	.	.	.	.
Spirifer duodenarius (Hall) Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Spirifer euruteines Owen, 11 Common. Falls of the Ohio (Hall), Charlestown (Nettleroth), Lexington, Lancaster, Falls of the Ohio, Watson, Sellersburg, Kent, Ind.	x	.	.	.	.

Spirifer fornacula (Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Spirifer fimbriatus Morton Clark county (Nettleroth).	x	.	.	.	.
*Spirifer granulosus (Con.) Abundant. Sellersburg, Paris Crossing. Falls of the Ohio, Lexington, Watson, Charlestown, Ind., Brooks, and Huber, Ky.	x	.	.	.	.
*Spirifer gregarius Clapp, 10 Falls of the Ohio, Falls of the Ohio (Hall), Scott county, Clark county, Charlestown, Bear Grass creek, Louisville, Sellersburg.	x	.	.	.	.
Spirifer grieri Hall Rare. Falls of the Ohio (Nettleroth), Paris Crossing.	x	.	.	.	.
Spirifer iowensis Owen Common. Paris Crossing, Falls of the Ohio, Watson, Ind., Bear Grass creek, Louisville, Ky.	x	.	.	.	.
*Spirifer keokuk Hall Abundant at most fossiliferous localities in the Riverside sandstone. Riverside, Brownstown, Low Gap Ridge, Pixley knob, and Edwardsville, Ind., and Parksville, Ky.	.	.	.	.	x
Spirifer hobbsi Nettleroth Falls of the Ohio (Nettleroth).	x	.	.	.	.
Spirifer lateralis Hall ? Rare. Parksville.	.	.	.	x	.
Spirifer macconathei Nettleroth Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Spirifer manni Hall Clark county.	x	.	.	.	.

*Spirifer marionensis Shumard, 8 Harrison county (Collett), Falls of the Ohio (Nettleroth). A small form of this species is common in the Rockford limestones at Crothersville and Guinea Knobs. Imperfect specimens from Brooks, Lebanon Junction, and Riley's, Ky., are referred to this species.	x?	.	x	x?	x?
*Spirifer mortonanus Miller Pixley knob, Ind., Brooks, Clearmont, and Crab Orchard, Ky.	.	.	.	x	x
*Spirifer mucronatus Conrad ? Clark county (Nettleroth).	x	.	.	.	.
Spirifer peculiaris Shumard "Knobstone," Harrison county (Collett).	.	.	.	.	.
Spirifer rostellatus Hall ? A few specimens from Pixley knob are doubtfully referred to this species.	.	.	x	.	.
*Spirifer segmentum Hall, 11 Rather common. Falls of the Ohio, and Charlestown landing (Hall), Sellersburg, Charlestown, Kent, Lexington, Ind.	x	.	.	.	.
Spirifer suborbicularis Hall Common. Pixley knob, Ind., Brooks, Clearmont, and Crab Orchard, Ky.	.	.	.	x	x
*Spirifer tullius Falls of the Ohio. This species has not been seen by me and is included on the authority of the Indiana State Museum catalogue.	x	.	.	.	.
*Spirifer varicosus Hall Common. Charlestown landing (Hall), Falls of the Ohio, Watson (Nettleroth), Bear Grass creek, Scipio, North Vernon, Lancaster, Lexington, Kent, Sellersburg, and Brooks, Ky., Huber, Ky.	x	.	.	.	.

Spirifer depressus Her.? Brownstown, Low Gap Ridge, and Bartel, Ind.	.	.	.	.	x
Spiriferina solidirostris White Abundant. Crothersville, Ind.	.	.	x	.	.
Spiriferina subelliptica (McChesney) Common. Riley's, Brooks, and Crab Orchard, Ky.	.	.	.	.	x
Streptorhynchus pectinaceum Hall New Albany (Hall).	.	.	.	.	x
*Stropheodonta concava Hall Rare. Charlestown and Sellersburg, Ind.	x	.	.	.	.
*Stropheodonta demissa Conrad (Con.) Common. Charlestown (Nettleroth), Lexington, Watson, Scipio, Lancaster, Falls of the Ohio, North Vernon, Bear Grass creek, Sellersburg, Paris Crossing, Kent.	x	.	.	.	.
*Stropheodonta hemispherica Hall Common. Falls of the Ohio (Hall), Clark county, Sellersburg, Lancaster, Charlestown, Lexington, North Vernon, Watson, Kent, Bear Grass creek.	x	.	.	.	.
*Stropheodonta inequistriata (Conrad) Rare. Falls of the Ohio (Nettleroth), Bear Grass creek, Charlestown.	x	.	.	.	.
Stropheodonta perplana (Conrad) Abundant. Falls of the Ohio (Nettleroth), Scipio, Lancaster, Kent, North Vernon, Watson, Bear Grass creek, Sellersburg, Charlestown, Paris Crossing, Crothersville, Ind., Brooks, Ky.	x	.	.	.	.
Stropheodonta plicata Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Syringothyris carteri (Hall) "Knobstone," Washington and Clark counties.	.	.	.	.	.

*Syringothyris texta (Hall) This is a common and characteristic fossil in the Riverside sandstone throughout the region. Found in the lower shale at but one locality—Pixley knob.	.	.	.	x	x
*Terebratula jucunda Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Tropidoleptus carinatus Conrad Common. Scott county (Borden), Clark county (Nettleroth), Lexington, Ind., Huber, Ky.	x	.	.	.	.

Mollusca.

LAMELLIBRANCHIATA.

Actinopteria boydi Con Rare. Falls of the Ohio (Nettleroth), Lancaster, Ind.	x	.	.	.	.
Actinopteria sp Borden, Ind.	.	.	.	.	x
Anatina leda Hall Rockford (James Hall).	.	.	x	.	.
*Aviculopecten crassicostatus Hall Falls of the Ohio (Nettleroth), (Hall).	x	.	.	.	.
*Aviculopecten intercostalis Winchell Charlestown.	x	.	.	.	.
*Aviculopecten pecteniformis Conrad Falls of the Ohio, Charlestown (Nettleroth).	x	.	.	.	.
Aviculopecten princips Rare. Falls of the Ohio (James Hall), Bear Grass creek, Louisville, Ky.	x	.	.	.	.
Aviculopecten fasiculatus Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Aviculopecten sp Low Gap Ridge and Brownstown, Ind.	.	.	.	.	x

Cardiopsis sp. Scipio and Lexington, Ind.	.	x	.	.	.
Cardiopsis radiata Meek and Worthen (Cardiomorpha radiata) Rockford (Meek and Worthen).	.	.	x	.	.
Clinopistha antiqua Meek Clark county (Nettleroth).	x	.	.	.	.
Clinopistha striata Nettleroth Clark county (Nettleroth).	x	.	.	.	.
Clinopistha subnasuta (H. and W.) Hall. Rare. Louisville, Ky. (James Hall), Clark county (Nettleroth), Lancaster, Ind.	x	.	.	.	.
Conocardium cuneum (Con.) Hall The three varieties of this species recognized by Hall occur abundantly in a single stratum at the Falls of the Ohio.	x	.	.	.	.
Conocardium exiguum Miller, 7 Bunker Hill.	x	.	.	.	.
Conocardium ohioense Meek Common. Falls of the Ohio (James Hall).	x	.	.	.	.
Conocardium parvulum Miller, 17 Bunker Hill.	x	.	.	.	.
Conocardium pulchellum Common at Bartel, Ind., and Crab Orchard, Ky.	x	.	.	.	.
Conocardium trigonale Hall, 11 Madison (Meek), Falls of the Ohio (Nettleroth).	x	.	.	.	.
Cypricardia ventricosa Hall Rockford (James Hall).	.	.	x	.	.
Cypricardinia sp. This species is closely related to, if not identical with, the Coal Measure species C. carbonaria. Brownstown, Low Gap Ridge, and Bartel, Ind., Brooks, Riley's, and Crab Orchard, Ky.	.	.	.	.	x

Cypricardinia cataracta Con. Falls of the Ohio (Nettleroth).	x	.	.	.	.
Cypricardinia ? cylindrica H. and W. Louisville, Ky. (James Hall), Falls of the Ohio (Nettleroth).	x	.	.	.	.
Cypricardinia indenta (Con.) Hall Falls of the Ohio (James Hall).	x	.	.	.	.
Cypricardinia inflata var. subequivalvis H. and W. Falls of the Ohio (Nettleroth).	x	.	.	.	.
Glyptodesma cancellatum Nettleroth Falls of the Ohio (Nettleroth).	x	.	.	.	.
Glyptodesma erectum Con. Common. Scipio, Lancaster, Ind.	x	.	.	.	.
Glyptodesma occidentale Hall Common. Falls of the Ohio (James Hall), Scipio, Paris Crossing, Lancaster, Charlestown, Ind., Falls of the Ohio.	x	.	.	.	.
Goniophora truncata Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Grammysia arcuata (Con.) H. Falls of the Ohio (James Hall).	x	.	.	.	.
Grammysia gibbosa H. and W. Falls of the Ohio (Nettleroth).	x	.	.	.	.
Grammysia rhomboidalis M. and W. Washington county (Gorby).	.	.	.	.	x
Grammysia ventricosta Meek Washington county (Gorby).	.	.	.	.	x
Leiopteria sp. A large species of this genus occurs abundantly in a single layer at Low Gap Ridge.	.	.	.	.	.
Limoptera cancellata Hall Falls of the Ohio (James Hall).	x	.	.	.	.
*Lunulicardium fragile Hall Scott county (James Hall).	.	x	.	.	.

Macrodon sp. A species closely related to M. blairi has been found at Bartel, Brownstown, Pixley knob, and Borden, Ind.	.	.	.	.	x
Macrodon newarkensis? An imperfect specimen is referred to this species from Riley's, Ky.	.	.	.	.	x
Modiomorpha affinis Hall Common. Clark county (James Hall).	x	.	.	.	.
Modiomorpha alta Hall Falls of the Ohio and Charlestown (James Hall).	x	.	.	.	.
Modiomorpha charlestownensis Nettleroth Clark county (Nettleroth).	x	.	.	.	.
Modiomorpha concentrica Hall Rare. Falls of the Ohio and Charlestown (James Hall), Lexington, Ind.	x	.	.	.	.
Modiomorpha mytiloides Con Clark county (Nettleroth), Falls of the Ohio.	x	.	.	.	.
Modiomorpha recta Hall Clark county (James Hall).	x	.	.	.	.
*Myalina keokuk Worthen Harrison and Washington counties, 8. Abundant in the sandstone at Low Gap Ridge and Borden, Ind.	.	.	.	.	x
Nucula sp. Rare. Bartel, Ind.	.	.	.	.	x
Nucula hians Hall Rockford (James Hall).	.	.	x	.	.
Nucula nov. sp. Crothersville, Ind.	.	.	x	.	.
Nucula lirata Conrad, 11 Shelby county.	x	.	.	.	.

Nucula neda H. and W. Louisville, Ky. (James Hall), Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Nucula niotica H. and W. Common. Falls of the Ohio (James Hall), (Nettleroth), Charlestown.	x	.	.	.	.
Nucula herzeri Nettleroth Falls of the Ohio (Nettleroth).	x	.	.	.	.
Palæoneilo sp. Crothersville, Ind.	.	.	x	.	.
Palæoneilo bedfordensis Meek Rather common at Pixley knob, Ind., and Riley's, Ky.	.	.	.	x	x
Panenka radians Conrad (Cardiola radians?) Scott county (Whitfield).	.	.	.	.	.
*Paracyclas elliptica Hall, 10 Falls of the Ohio and Charlestown, Ind. (James Hall), Lexington and Watson, Ind.	x	.	.	.	.
Paracyclas elongata Nettleroth Clark county (Nettleroth).	x	.	.	.	.
*Paracyclas lirata (Con.) Hall Falls of the Ohio and Clark county (James Hall).	x	.	.	.	.
Paracyclas octerlonii Nettleroth Falls of the Ohio (Nettleroth).	x	.	.	.	.
Paracyclas ohioensis Meek Clark county (Nettleroth).	x	.	.	.	.
*Pterinea flabellum Con. Rare. Falls of the Ohio, 11, Lancaster, Ind.	x	.	.	.	.
Pterinea grandis Hall Scott county (James Hall).	x	.	.	.	.
Pterinopecten nodosus Hall Falls of the Ohio (James Hall).	x	.	.	.	.

Pterinopecten reflexus Hall Falls of the Ohio (James Hall).	x	.	.	.	.
Pterinopecten sp. A single specimen from Borden, Ind.	.	.	.	.	x
Ptychodesma knappianum H. W. Falls of the Ohio (James Hall).	x	.	.	.	.
Schizodus chemungensis Rare. Borden, Ind.	.	.	.	.	x
Schizodus contractus Rare. Lancaster, Ind.	x	.	.	.	.
Schizodus medinensis Meek Knobstone, Washington county (Gorby).	.	.	.	.	.
Schizophoria sp. Riley's, Ky.	.	.	.	.	x
Solenomya (Janeia) vetusta Meek Falls of the Ohio (James Hall).	x	.	.	.	.
Spathella typica ? A specimen from Borden, Ind., is doubtfully referred to this species.	.	.	.	.	.
Sphenotus flavius Hall One specimen larger than those figured by Hall is provisionally referred to this apecies. Borden, Ind.	.	.	.	.	.
Streblopteria media Pixley knob and Low Gap Ridge, Ind.	.	.	.	.	x
Yoldia ? valvulus H. and W. Clark county (Nettleroth).	x	.	.	.	.

Gastropoda.

*Bellerophon crenistria Hall Clark county.	x	.	.	.	.
*Bellerophon cyrtolites Hall Rockford (Hall), (Meek and Worthen).	.	.	x	.	.
*Bellerophon fatulus Hall, 11 Charlestown and Shelby county, Ind.	x	.	.	.	.

Bellerophon galesriculatus Winch.? Common at Bartel, Ind.	.	.	.	.	x
Bellerophon leda Hall Clark county (Nettleroth).	x	.	.	.	.
Bellerophon lineolatus Hall Rockford (James Hall).	.	.	x	.	.
Bellerophon lyra Hall Louisville, Ky. (Hall and Whitfield).	x	.	.	.	.
*Bellerophon pelops Hall Charlestown.	x	.	.	.	.
Bucania devonica H. and W. Rather rare. Clark county (Nettleroth) (Hall and Whitfield), Kent, and Charlestown, Ind.	x	.	.	.	.
Callonema bellatulum Hall Rare. Falls of the Ohio (Nettleroth), Kent, Ind.	x	.	.	.	.
Callomea imitator H. and W. Common. Clark county (Nettleroth), Falls of the Ohio.	x	.	.	.	.
Cyclonema cancellatum? Rare. Lancaster, Ind.	.	.	.	.	.
Cyclonema pulchellum Mill. and G. Knobstone, New Albany (Miller and Gurley).	.	.	.	.	.
*Euomphalus cyclostomus Hall Shelby county, Ind., 11.	x	.	.	.	.
Euomphalus decewi Bill. Clark county (Nettleroth), Charlestown, Ind.	x	.	.	.	.
Euomphalus lens Hall. (See Straparollus lens)	.	.	x	.	.
Euomphalus sampsoni Nettleroth Clark county (Nettleroth).	x	.	.	.	.
*Euomphalus tioga Hall Charlestown.	x	.	.	.	.

Holopea grandis M. and G. Knobstone, New Albany (M. and G.	.	.	.	.	.
*Isonema lichas Hall Charlestown.	x	.	.	.	.
Loxonema hamiltonæ Hall Clark county (Nettleroth).	x	.	.	.	.
*Loxonema hydraulicum H. and W. Charlestown (Nettleroth), Kent, Ind.	x	.	.	.	.
Loxonema lævisculum Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Loxonema nexile Phillips, 11 Shelby county, Ind.	x	.	.	.	.
Loxonema rectistriatum Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Loxonema teres Hall Falls of the Ohio and Charlestown.	x	.	.	.	.
Loxonema sp. Rare. Borden, Ind.	.	.	.	.	x
Loxonema nov. sp. Common. Parksville, Ky.	.	.	.	.	.
Macrochilina carinata Nettleroth Rare. Falls of the Ohio (Nettleroth), Lexington, Ind.	x	.	.	.	.
Murchisonia desiderata Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Murchisonia indianensis M. and G. Knobstone, New Albany (M. and G.).	.	.	.	.	.
Murchisonia (Pleurotomaria) limitaris Hall Rockford (James Hall).	.	.	x	.	.
Naticopsis sp. Rare. Bartel, Ind.	.	.	.	.	x
*Naticopsis gigantea Hall Falls of the Ohio.	x	.	.	.	.
*Naticopsis lævis Meek Charlestown.	x	.	.	.	.

*Platyceras ammon Hall…………………… Charlestown.	x	.	.	.	.
Platyceras attenuatum Hall, 6…………… Madison.	x	.	.	.	.
Platyceras buculentum H…………………… Rare. Clark county (Nettleroth), Kent, Ind.	x	.	.	.	.
*Platyceras carinatum Hall………………… Charlestown and Falls of the Ohio, Scipio, Ind., Bear Grass creek, Louisville.	x	.	.	.	.
Platyceras compressum Nettleroth………… Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Platyceras conicum Hall…………………… Falls of the Ohio (Nettleroth).	x	.	.	.	.
Platyceras crassum Hall?…………………… Rare. Kent, Ind.	x	.	.	.	.
*Platyceras cymbium Hall………………… Charlestown.	x	.	.	.	.
*Platyceras dumosum Conrad …………… Clark and Jennings counties (Nettleroth), Falls of the Ohio, Bear Grass creek, Louisville.	x	.	.	.	.
*Platyceras dumosum var. rarispinum Hall Falls of the Ohio.	x	.	.	.	.
*Platyceras echinatum Hall………………… Clark county (Nettleroth), Bear Grass creek, Louisville.	x	.	.	.	.
*Platyceras erectum Hall…………………… Charlestown (Nettleroth), Lancaster, Kent, and Lexington, Ind.	x	.	.	.	.
Platyceras (Orthonychia) fluctuosum Ulrich…………………………………… Falls of the Ohio (Ulrich).	x	.	.	.	.
*Platyceras haliotoides M. and W………… Rockford.	.	.	x	.	.

Platyceras herzeri Winch.? Rare. Crab Orchard, Ky.	.	.	.	.	x
Platyceras indianense M. and G. Charlestown (M. and G).	x	.	.	.	.
Platyceras infundibulum M. and W., 8. Knobstone, Washington county, Harrison county.	.	.	.	.	.
Platyceras milleri Nettleroth. Falls of the Ohio (Nettleroth).	.	.	.	.	.
Platyceras lodense Meek. Rare. Parksville, Ky.	.	.	.	.	x
*Platyceras multispinosum Meek. Falls of the Ohio (Nettleroth).	x	.	.	.	.
Platyceras quinquesinuatum (Ulrich). Falls of the Ohio (Ulrich).	x	.	.	.	.
Platyceras rictum Hall. Clark county (Nettleroth).	x	.	.	.	.
Platyceras serratum Ulrich. Falls of the Ohio (Ulrich).	x	.	.	.	.
*Platyceras subundatum Conrad. Falls of the Ohio.	x	.	.	.	.
Platyceras symmetricum Hall. Clark county (Nettleroth).	x	.	.	.	.
*Platyceras thetis Hall. Falls of the Ohio, Charlestown (Nettleroth.	x	.	.	.	.
Platyceras uncum Meek and Worthen, 8. Knobstone, Harrison county.	.	.	.	.	.
*Platyceras ventricosum Conrad. Clark county (Nettleroth).	x	.	.	.	.
Platystoma lineatum Hall. Rare. Clark county (Nettleroth), Lancaster, Falls of the Ohio, Brooks, Ky.	x	.	.	.	.
Platystoma lineatum var. callosum Hall. Clark county (Nettleroth), Kent, Ind.	x	.	.	.	.

Platystoma turbinatum Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Platystoma turbinatum var. cochleatum H. Louisville, Ky. (Nettleroth).	x	.	.	.	.
*Pleuronotus decewi Billings Falls of the Ohio.	x	.	.	.	.
Pleurotomaria sp. An unfigured species occurs abundantly in the sandstone at Borden and Low Gap Ridge, Ind.	.	.	.	.	x
Pleurotomaria arabella Nettleroth Clark county (Nettleroth).	x	.	.	.	.
*Pleurotomaria imitator Hall Charlestown.	x	.	.	.	.
*Pleurotamaria lucina Hall Charlestown and Bartholomew county.	x	.	.	.	.
*Pleurotomaria lucina var. perfasciata Hall Falls of the Ohio, Clark county (Nettleroth).	x	.	.	.	.
Pleurotomaria mitigata Hall Rockford (James Hall).	.	.	x	.	.
Pleurotomaria procteri Nettleroth Clark county (Nettleroth).	x	.	.	.	.
*Pleurotomaria sulcomarginata Con. Rare. Falls of the Ohio (Nettleroth). Lancaster, Ind.	x	.	.	.	.
Pleurotomaria textiligera Meek Knobstone, Washington county (Gorby).	.	.	.	.	.
Pleurotomaria vadosa H. Rockford (James Hall).	.	.	x	.	.
Polyphemopsis sp. Rare. Pixley Knob, Ind.	.	.	.	x	.
Polyphemopsis louisvillæ H. and W. Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Straparollus lens Hall Rockford (Hall).	.	.	x	.	.

Straparollus spirorbis Hall (Euomphalus spirorbis) Rockford (James Hall).	.	.	x	.	.
Strophostylus sp. Rare. Bartel, Ind.	.	.	.	.	x
Strophostylus varians Hall Falls of the Ohio (Nettleroth).	x	.	.	.	.
Trochonema emaceratum Hall Louisville (Hall and Whitfield).	x	.	.	.	.
Trochonema rectilaterum Hall Falls of the Ohio (Nettleroth) (Hall), Charlestown, Ind.	x	.	.	.	.
Trochonema yandellanum Hall and W. Falls of the Ohio (Nettleroth) (Hall).	x	.	.	.	.
Turbo shumardi de Verneuil Rare. Clark county (Nettleroth), Falls of the Ohio.	x	.	.	.	.

Pteropoda.

Coleolus acicula Hall Lexington, Ind.	x	.	.	.	.
*Coleolus tenuicinctus Hall Falls of the Ohio and Charlestown (Hall).	x	.	.	.	.
*Conularia micronema Meek, 8 Clark county.	.	.	.	.	x
*Conularia newberryi Winchell Rare. Harrison county, 8, New Albany, Brownstown, and Low Gap Ridge, Ind.	.	.	.	.	x
Hyolithes aculeatus Hall (Puginculus aculeatus) Rocksord (James Hall).	.	.	x	.	.
Hyolithes nov. sp. Rare. Borden, Ind.	.	.	.	.	x

*Styliola fissurella Hall (Tentaculites fissurella) New Albany and Scott county (Whitfield), Falls of the Ohio (Nettleroth).	x	x	.	.	.
Tentaculites scalariformis Hall Common. Clark county (Nettleroth), Scipio, and Lancaster, Ind.	x	.	.	.	.

Cephalopoda.

Brancoceras ixion (Hall) Scott county and Rockford (Hall).	.	.	x	.	.
Cyrtoceras jasoni Rare. Lexington, Ind.	x	.	.	.	.
*Cyrtoceras ohioense Meek Charlestown.	x	.	.	.	.
Gomphoceras minum Beecher Falls of the Ohio (James Hall), Lexington, Ind.	x	.	.	.	.
*Gomphoceras oviforme Hall Charlestown (Nettleroth).	x	.	.	.	.
*Gomphoceras raphanum Hall Charlestown.	x	.	.	.	.
*Gomphoceras turbiniforme M. and W. Charlestown (Meek and Worthen) (Nettleroth).	x	.	.	.	.
Goniatites brownensis Miller, 17 (Knobstone), Brown county (Miller).	.	.	.	.	.
Goniatites greenei Miller Rare. New Albany, 18, and Bartel, Ind.	.	.	.	.	x
Goniatites indianensis Miller, 17 Knobstone, Clark county (Miller).	.	.	.	.	.
*Goniatites lyoni M. and W. Rockford (Meek and Worthen), Crothersville, Ind.	.	.	x	.	.

Gyroceras gracile (Hall) Rockford (James Hall).	.	.	x	.	.
*Gyroceras inelegans Meek Falls of the Ohio.	x	.	.	.	.
Gyroceras jason Hall Rare. Lexington, Ind.	x	.	.	.	.
Gyroceras? rockfordensis M. and W. Rockford (Meek and Worthen).	.	.	x	.	.
*Munsteroceras oweni (Hall) Common. Scott county, 10, Rockford (Hall), Crothersville, Ind.	.	.	x	.	.
*Munsteroceras parallum (Hall) Rockford (James Hall).	.	.	x	.	.
Nautilus maximus Conrad Falls of the Ohio (Nettleroth).	x	.	.	.	.
*Nautilus (Cryptoceras) rockfordensis M. and W. Rockford (M. and W.).	.	.	x	.	.
Nautilus (Discus) trisulcatus M. and W. Rockford (M. and W).	.	.	x	.	.
Orthoceras sp. Brownstown, Pixley knob, and New Albany, Ind.	.	.	.	.	x
Orthoceras caldwellense M. and G. Clark county (M. and G.).	x	.	.	.	.
*Orthoceras heterocinctum Winch. Rockford.	.	.	x	.	.
Orthoceras icarus Beecher Rare. Rockford (James Hall), Crothersville.	.	.	x	.	.
Orthoceras indianense Hall Common. Rockford (James Hall), Crothersville, Ind.	.	.	x	.	.
Orthoceras marcellense Vanuxem Rockford (James Hall).	.	.	x	.	.

*Orthoceras whitii Winch. Rockford.	.	.	x	.	.
*Phragmoceras walshi M. and W.? Jeffersonville.	x	.	.	.	.
Remeleceras clarkense M. and G. Sampson Springs, Clark county, Ind., (M. and G.).	.	.	.	x	.
Soleniscus rockfordense Miller, 17 Rockford.	.	.	x	.	.
Solenochilus henryvillense M. and G. Knobstone, Henryville, Ind. (M. and G.	.	.	.	.	.
Solenochilus rockfordense Miller Rockford (Miller).	.	.	x	.	.
Trematodiscus digonus M. and W. (Nautilus digonus) Jackson county (Collett).	.	.	.	.	x
Trematodiscus trisulcatus M. and W. (Nautilus trisulcatus) Rockford (M. and W.).	.	.	x	.	.

Arthropoda.

Class Crustacea.

PALÆOSTRACA.

Calymene platys Greene Falls of the Ohio (Hall and Clark).	x	.	.	.	.
Dalmanites anchiops var. sobrinus H. and C. Falls of the Ohio (H. and C.).	x	.	.	.	.
Dalmanites (Coronura) aspectans Conrad Falls of the Ohio (H. and C.).	x	.	.	.	.
Dalmanites (Chasmops) calypso Hall Falls of the Ohio (H. and C.).	x	.	.	.	.
Dalmanites selenurus Rare. Falls of the Ohio.	x	.	.	.	.

*Dalmanites ohioensis M. and W. Madison and Falls of the Ohio.	x	.	.	.	.
Dalmanites (Cryphæus) pleione Hall (Dalmania pleione) Falls of the Ohio and Jennings county (H. and C.).	x	.	.	.	.
*Phacops bufo Green Rare. Charlestown, North Vernon, and Falls of the Ohio (M. and G.)., Watson, Lexington, Lancaster, Ind.	x	.	.	.	.
Phacops rana Green Rare. Brooks, Ky.	x	.	.	.	.
Phacops cristata var. pipa H. and C. Rare. Falls of the Ohio (H. and C.)., Bear Grass creek, Louisville.	x	.	.	.	.
Phillipsia rockfordensis Winch Rockford (Herrick).	.	.	x	.	.
Phæthonides n. sp. A species closely allied to P. spinosus occurs at Bartel, Ind., and Crab Orchard, Ky.	.	.	.	.	x
Piliolites ohioensis Cozzens Falls of the Ohio (Cozzens).	x	.	.	.	.
Proetus auriculatus Hall Rare. Crab Orchard, Ky., and Low Gap Ridge and Bartel, Ind.	.	.	.	.	x
Proetus canaliculatus H. and C. Common. Falls of the Ohio (H. and C.)., Scipio, Ind.	x	.	.	.	.
Proetus clarus Hall Falls of the Ohio (James Hall and J. M. Clarke).	x	.	.	.	.
*Proetus crassimarginatus Hall Common. Falls of the Ohio (Hall), Brooks, Ky., Bear Grass creek, Louisville.	x	.	.	.	.
Proetus doris Hall Rockford, Ind. (Hall) (Herrick.	.	.	x	.	.

*Proetus longicaudus Hall Falls of the Ohio.	x	.	.	.	.
Proetus microgemma H. and C. Rare. Falls of the Ohio (H. and C.).	x	.	.	.	.
*Proetus planimarginatus Meek Madison, Falls of the Ohio.	x	.	.	.	.

Entomostraca.

Aparchites inornatus Ulrich Falls of the Ohio (E. O. Ulrich).	x	.	.	.	.
Barychilina puncto-striata Ulrich Indiana (Ulrich).	x	.	.	.	.
Barychilina puncto-striata var. cutta Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Barychilina pulchella Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Beyrichia (Depranella?) kalmodini Jones Falls of the Ohio (Ulrich).	x	.	.	.	.
Beyrichia lyoni Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Bollia obesa Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Bollia pumila Ulrich Weisburg, Ind. (Ulrich).	x	.	.	.	.
Bythocypris indianensis Ulrich Falls of the Ohio)A. E. Ulrich).	x	.	.	.	.
Bythocypris punctulata Ulrich Falls of the Ohio (A. E. Ulrich).	x	.	.	.	.
Ctenobolbina (Bollia?) antespinosa Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Ctenobolbina informia Ulrich Falls of the Ohio.	x	.	.	.	.
Ctenobolbina papillosa Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.

Cytheropsis sp. Little York, Washington county, Ind.	.	.	.	x	.
Halliella retifera Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Isochilina rectangularis Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Kirkbya subquadrata Ulrich Falls of the Ohio (Ulrich).	x	.	.	.	.
Leperditia sp. Crothersville, Ind.	.	.	x	.	.
Leperditia ? subrotunda Ulrich Falls of the Ohio (E. O. Ulrich).	x	.	.	.	.
Octonaria clavigera Ulrich Falls of the Ohio (A. E. Ulrich).	x	.	.	.	.
Octonaria devonica Ulrich Falls of the Ohio (A. E. Ulrich).	x	.	.	.	.
Octonaria ovata Ulrich Falls of the Ohio (E. O. Ulrich).	x	.	.	.	.
Octonaria stigmata Ulrich Falls of the Ohio (E. O. Ulrich).	x	.	.	.	.
Octonaria stigmata var. loculosa Ulrich Falls of the Ohio (E. O. Ulrich).	x	.	.	.	.
Octonaria stigmata var. oblonga Ulrich Falls of the Ohio (E. O. Ulrich).	x	.	.	.	.
Pachydomella tumida Ulrich Falls of the Ohio (A. E. Ulrich).	x	.	.	.	.

Vertebrata.

PISCES.

Gyracanthus compressus Newberry Dearborn county (Newberry).	.	.	.	.	.
Machæracanthus major Newberry Rare. Lexington, Ind.	x	.	.	.	.

Macropetalichthys rapheidolabis Norwood and Owen (Norwood and Owen).	x	.	.	.	.
Onychodus sigmoides Newberry ? Common. Scipio, North Vernon, Paris Crossing, Lancaster, Ind.	x	.	.	.	.
Orodus multicarinatus N. and W. (Norwood snd Worthen).	.	.	x	.	.

Plantæ.

Dadoxylon newberryi Dawson Marion county, Ky. (Knott).	.	x	.	.	.
Palæophycus lineare Duden New Albany (Duden).	.	x	.	.	.
Palæophycus newalbense Duden New Albany (Duden).	.	x	.	.	.
Parenchymophycus asphalticum Duden New Albany (Duden).	.	x	.	.	.
Sporangites radiatus Duden New Albany (Duden).	.	x	.	.	.

PART IV.

* * *

Discussion and Correlation of Faunas.

Eocarboniferous Faunas.

* * *

REVIEW OF PREVIOUS CORRELATIONS.

Very diverse conclusions have been reached as to the proper correlation of these faunas in the Mississippi valley by paleontologists. The controversy relative to the age of the beds variously referred to the Waverly, the Marshall group, the Kinderhook, and the Chemung is one of long standing. The history of these discussions has been well presented by Winchell* and more recently by Williams†. It seems unnecessary therefore to review the history of opinion on this question except in so far as it relates directly to the faunas in Indiana and Kentucky.

In 1841 Prof. James Hall made a brief examination of the beds in Indiana between the Black shale and the Carboniferous limestone. He identified the green shales of the Knobstone (New Providence shale) with the Portage of New York. Of the fossils in the sandstones above these shales he says: "I found shells with close analogy, if not absolute identity, with Chemung species."‡ But the discovery of other shells of Carboniferous type

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*Proc. Am. Phil. Soc., vol. 11, pp. 57-83.
†Bull. U. S. Geol. Surv., No. 80, pp. 173-192.
‡Trans. Am. Assoc. Geol. and Nat., 1840-42, p. 280.

led him to modify this statement by saying: "I was led to question the inference as to absolute identity."* The beds were classed by Hall as Carboniferous. Prof. Hall explained his application of the term "sub-carboniferous" to the upper sandstone and shales of the Knobs in the following words: "The more friable and micaceous sandstones above containing fossils of true Carboniferous types, I called sub-carboniferous from the fact that up to that time I was not aware that anything below the base of the great Carboniferous limestone had been recognized as belonging to the Carboniferous period."†

The correlation of the shaly beds below the sandstone with the Portage and Chemung groups was based solely upon their lithological resemblance to the New York formations. Hall states that he was unable to find fossils within two hundred feet above the Black shales. Fossils have been found in abundance in these beds since Hall's examination of them, and their fauna is now known to present almost as strongly marked Carboniferous affinities as that of the sandstones above.

In an elaborate paper on the parallelism of American and European palæozaic formations, the distinguished geologist de Verneuil expressed the opinion that "in the states of Indiana, Kentucky, and Tennessee the Carboniferous system comprises all of the micaceous sandstone as far as the Black shales, their lower beds including true Carboniferous species such as the *Spirifer striatus*, *Productus punctatus*, etc."‡

The beds above the Black shale were divided into three groups by de Verneuil, as follows:||

Carboniferous System.	Sandstones, shales, and limestones of the coals.
	Carboniferous limestone.
	Fine grained micaceous sandstone.

The discussion of the parallelism of eastern and western formations was resumed by Prof. Hall again in 1850.§ He seemed

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*Trans. Am. Assoc. Geol. and Nat., vol. 1, p. 28.

† " " " " " " " " " "

‡Am. Jour. Sci., 2d. ser., vol. 7, p. 46, 1849.

||Ib.

§Foster and Whitney's Rept. on Geol. L. Sup. Land. Dist., pt. 2, p. 307.

still not quite willing to agree with de Verneuil as to the Carboniferous age of all the sandstones and shales above the Black shale, and says: "The green shales and yellow sandstones of Ohio and Indiana which succeed this black shale have been recognized as Carboniferous by their fossils, though there is still some doubt whether the lower part may not represent the Chemung group of New York."*

In 1851 Mr. Christy, in a communication to the American Association,† announced that he had found the Rockford limestone to be centrally located in the Black shale, about thirty feet of shale lying above it. This conclusion has since been shown to be eroneous. All who have since studied the stratigraphy of these formations concur in placing the Rockford limestone at the top of the Black shale.

D. D. Owen‡ classed the "Knob formation" of Kentucky as the base of the sub-carboniferous in 1856. In 1860 Meek and Worthen in describing a new *Sphenopterium* from the Rockford limestone stated that the specimen is "from beds probably of Upper Devonian age, but containing Carboniferous *Goniatites*."||

In 1860 Sidney Lyon§ published a section of the rocks of Kentucky, in which he classed with the "Sub-carboniferous Series" the "Knobstone Beds," as well as the beds below them, down to and including the *Catinopora* beds of the Niagara.

In a paper published by Prof. Hall¶ in 1861 he attempts to prove the parallelism of the Rockford limestone and the band of limestome occurring in the midst of the Marcellus shale. In this paper the Rockford *Goniatites* are considered of Hamilton age and the Knob sandstone and shales "are recognized as of the age of the Chemung group of New York."

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*Foster and Whitney's Rept. on Geol. L. Sup. Land. Dist., pt. 2, p. 307.

†Proc. Am. Assoc., vol. 5, p. 76.

‡Ky. Geol. Rept., vol. 1, p. 89.

||Description of New Carboniferous Fossils from Illinois and Other Western States, Proc. Phil. Acad. Nat. Sci., Sept. 1860, p. 447.

§Trans. St. Louis Acad. Sci., 1, pp. 614-619.

¶13th Rept. N. Y. Regents, p. 95.

In 1861 Meek and Worthen[*] published a paper on the age of the Goniatite limestone at Rockford, Ind. The erroneous assertion of Christy that the Rockford limestone is central in the Black shale is corrected by these authors, who state that the Black shale lies entirely below the limestone. The Rockford limestone is identified by them to be of the same age as the Chouteau limestone of Missouri. This determination is based upon the identification of at least six of the twenty-three or twenty-four known Rockford species with characteristic Chouteau species. These species are *Nautilus digonus* M. and W., *Euomphalus lens* Hall, *Rhychonella missouriensis* Shumard, *Spirifer coopercnsis* Swall., *Cardiopsis radiata* M. and W., and *Sphenopterium enorme* M. and W.

It seems to the writer that in correlating the Rockford limestone with other formations in the Mississippi valley considerable weight should be given to the stratigraphic evidence, since it lies directly above the Black shale, a formation which may be readily recognized throughout most of the Paleozoic area of the Mississippi valley. Should the stratigraphic evidence be given principal weight, the Rockford limestone would be correlated not with the Chouteau, but with the Lithographic limestone. Both the Rockford and the Lithographic limestones lie immediately above the Black shale. Both are rather local in their extent. The lithological description given by Worthen of the Lithographic limestone is in part as follows: "It is usually of a light bluish-green or dove color, weathering to a drab. It breaks with a smooth conchoidal fracture."[†] It would be difficult to give a better physical description of the Rockford limestone of Southern Indiana than this. The Lithographic limestone is stated by these authors to be "rather local,"[‡] which is also a characteristic of the Rockford limestone.

The following section[||] is given of the Missouri beds:

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[*] Am. Jour. Sci., 2d ser., vol. 32, p. 167.
[†] Geol. Surv. of Ill., vol. 1, p. 114.
[‡] Am. Jour. Sci., vol. 32, 2d ser., p. 170.
[||] Ib.

		Feet.
1.	Burlington limestone	200
2.	Chouteau	100
3.	Vermicular sandstone and shale	65–100
4.	Lithographic limestone (rather local)	60
5.	Black shale	30 – 40
6.	Hamilton group	120

In southern Indiana we have the following section (generalized):

	Feet.
Carboniferous limestones	300–400
Massive to shelly sandstone	150–300
Argillaceous blue to green shales	50–200
Black shale	100–120
Hamilton	

The relative position of the Rockford limestone and the Lithographic limestone in these two sections affords very strong stratigraphic evidence of their equivalence. According to Meek and Worthen not one of the fossils occurring in the Lithographic limestone can be positively identified with Hamilton species with the possible exception of an *Orthis*, while many of the fossils in it occur in the Chouteau beds. The fossils therefore present no evidence against correlating the Lithographic and the Rockford beds. On the other hand, if the Rockford limestone is the equivalent of the Chouteau it seems remarkable that *Syringothyris carteri*, which is a common species in the Chouteau, should be represented by the closely related species S. *texta* in the Knobstone of the Indiana section, while the genus is entirely unknown in the Rockford limestone.

In the face of evidence now at hand it seems to us that the Rockford limestone must be considered the equivalent of the Lithographic or Louisiana limestone of the later Missouri reports.

In a foot note[*] to this paper the authors propose the name "Kinderhook group," to include the beds lying between the Black slate and the Burlington limestone.

During the year 1862 Prof. Hall was led to change his opinion regarding the Marcellus age of the Rockford *Goniatites* by finding the Rockford species G. *hyas* among fossils from the Waverly of Ohio. This led him to "conclude that the position assigned to the *Goniatites* beds of Rockford may be erroneous and that the true position is higher in the series or more nearly in a parallel with the Chemung group."[†]

In 1862 Messrs. White and Whitfield published a paper entitled "Observations upon the Rocks of the Mississippi Valley Which Have Been Referred to the Chemung Group of New York, Together with Descriptions of New Species of Fossils from the Same Horizon at Burlington, Iowa."[‡] The authors state that sufficient fossils have not been found to determine the age of the lower Knob shales in Indiana and Kentucky. The fossils of the upper sandstones they consider to be more nearly related to those of the Keokuk than to those of the Burlington limestone or the Chemung rocks of the Mississippi valley. "Barely enough of the fossils of the Burlington limestone are recognized there to show that it is represented."[||]

During the same year Prof. A. Winchell published two papers on the Marshall and Huron groups of Michigan. In one of these[§] five species from the Marshall group are identified with fossils previously described from Rockford, Ind.

In 1862 Prof. Robert Owen[¶] designated the sandstones and shales below the Carboniferous limestone as "sub-carboniferous," after D. D. Owen.

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[*] Am. Jour. Sci., 2d ser., vol. 32, 1861, p. 288.

[†] 15th Rept. N. Y. Regents, p. 81.

[‡] Proc. Bost. Soc. Nat. Hist., vol. 8, p. 289.

[||] Ib., p. 292.

[§] Proc. Acad. Nat. Sci. Phil., 1862, p. 405.

[¶] Ind. Geol. Rept., 1862, pp. 92, 108, etc.

In 1863 Prof. A. Winchell* endeavored to show by a synopsis of the paleontological evidence that the Chemung, Waverly, Marshall, Rockford, and Burlington beds were synchronous and should be classed within the Carboniferous system.

In 1865 Prof. Winchell presented another paper on these rocks. He had compared a large number of species from western rocks supposed to be of Chemung age with the types of the New York Chemung and failed to identify a single species with Chemung types. Some of the Waverly species, however, were found to be identical with fossils from the conglomerate in western New York which had been identified with the Carboniferous of Pennsylvania. This led Winchell to abandon his former opinion of the Carboniferous age of the Chemung and its correlation with the Waverly, Marshall, and Rockford beds of the west, and to incline to the view that the conglomerate of western New York is "the attenuated and littoral prolongation of those western sandstones and shales."

During the year 1866 the first volume of the Illinois Survey† was published, in which Mr. Worthen describes at some length the Kinderhook group. This group, he states, includes the Chouteau limestone, the Lithographic limestone, and the Vermicular sandstone and shales of the Missouri Report, the so-called Chemung of Iowa, the Waverly of Ohio, and the Goniatite limestone of Rockford, Ind. The following section is given at Hamburg, Calhoun county, Illinois:

	Feet.
Green arenaceous and argillaceous shales	60–70
Shelly oolitic limestone	8–10
Compact fine-grained limestone	15–20

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*Am. Jour. Sci., 2d ser., vol. 35, p. 61.
†P. 109.

Worthen identified the Knobstone of southern Indiana, the argillaceous shales at Crawfordsville, and about "thirty feet of greenish-colored shale and shaly sandstone" and thin band of limestone lying below the conglomerate near Williamsport, Ind., with the Keokuk. The sandstones below the limestone band at Williamsport he refers to the Kinderhook on lithological grounds, no fossils being reported from it. The determination of the Keokuk age of the formations mentioned above is based by Worthen upon the presence in them of *Spirifer cuspidatus*, *Hemipronites crenistria*, *P. semireticulatus*, *Orthis michelini*, *P. punctatus*, and *Spirifer lineatus*.

The equivalency of this fauna with the Keokuk fauna can hardly be proven by the evidence of the species cited, since not one of them is distinctly characteristic of the Keokuk fauna. *Productus punctatus* and *P. semireticulatus* are known to range throughout the Carboniferous. *Spirifer lineatus* (*Reticularia perplexa*) is regarded as an Upper Carboniferous species and if present would tend to indicate a higher horizon for the Knobstone than the Keokuk. It is very probable, however, that Worthen mistook *Reticularia pseudolineata* (Hall), which is common to the Burlington and Keokuk, for *Spirifer lineatus*. *Spirifer cuspidatus* (*Syringothyris carteri*) has been reported from both Waverly and Burlington faunas, but not from the Keokuk. *Hemipronites crenistria* (Phillips?) is common to the Lower Carboniferous. *Orthis michelini* (*Rhipidomella michelini*) is recorded from the Waverly, but apparently has never been reported from the Keokuk limestone. From this review of Worthen's evidence of the Keokuk age of the sandstones and shales below the Carboniferous it appears that it points rather to a Burlington or Waverly age for them than to parallelism with the Keokuk.

In 1869 Prof. A. Winchell published a paper* reviewing the history of the various attempts to correlate the Lower Carboniferous formations of the Mississippi valley and summing up the stratigraphical knowledge relative to them. The Knobstone series in Indiana is referred to the Keokuk group. The Rockford limestone is said to be represented in northern Indiana by a thin bedded sandstone. It is not quite clear just what sandstone was referred to in this correlation, but it was probably the Riverside.

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*Proc. Am. Phil. Soc., vol. 11, pp. 57-82.

In 1870 Prof. Winchell published a paper on the "Geological Age and Equivalents of the Marshall Group."* A catalogue of the fossils of the Marshall group and its supposed equivalents in the United States is given. From this catalogue it appears that there are nine species common to the Rockford limestone and the Marshall group. The Rockford limestone and a sandstone in northern Indiana, which in the table of geological equivalents is called the Williamsport sandstone, are correlated with the Marshall group. The exact stratigraphic position of the Williamsport sandstone is not shown and no satisfactory reasons are given for considering it the equivalent of the Rockford limestone. The presence in the Marshall group of such a characteristic Rockford species as *Goniatites oweni* affords strong evidence that the Rockford limestone is the equivalent of some part of the Marshall group, but that the three hundred feet† of sandstones and shales constituting Winchell's Marshall group in Michigan should be represented by only three or four feet of limestone in southern Indiana is not probable.

The Report of the State Geologist of Indiana for 1873 contains the following section of the rocks in the southern part of the state by W. W. Borden‡:

		Feet.
Soil and clay		20 – 40
Knob limestone—Keokuk group		80
Knob sandstone. Knob shale.	Kinderhook group	344
New Albany Black slate. Crinoidal limestone. Hydraulic limestone.	Hamilton group	140

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*Proc. Am. Phil. Soc., 12, pp. 385-418.
†Proc. Am. Phil. Soc., vol. 11, p. 74.
‡P. 172.

	Feet.
Corniferous limestone.—Upper Helderberg group...........	22
Utica limestone.—Niagara group..............................	30
Madison limestone.—Cincinnati group.......................	207
Magnesian limestone.—Clinton group.........................	30

It will be noted that the Rockford limestone, from which the typical Kinderhook fauna was described, is entirely omitted from the above section.

No important additions have been made to the literature relative to the geological equivalents of the Rockford limestone and the shales and sandstones above them in Indiana since the appearance of Winchell's paper in 1870. A number of new fossils have been described from the sandstones and shales of the Knobs by Hall and Clark and Miller and Gurley. In referring a new species to the Knobstones group Miller and Gurley explain that it "means the Keokuk group and the Waverly, where the two are not separable and the fossils are generally casts."*

Hall and Clark†, in referring to the age of the "Knobstone group," state that "the lowest member has generally been regarded as of the age of the Waverly and the upper member equivalent to the Keokuk."

Quite recently Mr. Miller‡ has attempted to prove by stratigraphic evidence that the Waverly of Ohio and eastern Kentucky formerly extended across the Silurian area and were continuous with the Knobstone and superior formations in Indiana and Kentucky west of the Cincinnati geanticline.

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*Bull. Ill. Surv., No. 12, p. 50.

†Pal. N. Y., vol. 8, pt. 1, p. 225.

‡Am. Geol., August '98.

RELATIONS OF THE FAUNAS.

ROCKFORD LIMESTONE FAUNA.

The fauna of the Rockford limestone is quite unlike either the fauna above or below it in the Indiana sections, although its affinities are distinctly Carboniferous. A study of the species recorded from the Rockford fauna in Part III shows that seventeen species, or more than one third of the total number reported in it, belong to the *Cephalopoda*. Nearly all of the species of this fauna have been described from Rockford, and very few of these have been reported from other horizons or localities.

The only species of *Protozoa* recorded from this fauna is also reported by Keyes from the Kinderhook of Missouri.

Of the two corals only one is known elsewhere, and this one is reported doubtfully from just above the Black shale in Tennessee and the Waverly in Ohio.

Of the four Brachiopods which have been positively identified in this fauna one is known from the Kinderhook and one from the Waverly outside of the state, while the other two are unknown outside of the Rockford limestone. Not one of these four has been identified in the faunas above or below the Rockford limestone. The presence in the fauna of a *Leiorhynchus*, which is probably *L. quadicostatus* and *Ambocœlia gregaria*, affords the only trace of Devonian affinities observed in the fauna.

Nine Gastropods have been recorded from the Rockford limestone, none of which are known in the other faunas of the Indiana and Kentucky sections.

The Cephalopods are represented by seventeen species, all of which, so far as known, are limited in Indiana and Kentucky to this fauna.

Only two species of Trilobites have been described from the Rockford fauna, one of which, *Proctus doris*, has been identified by Herrick in the Ohio Waverly.

The unique character of the Rockford limestone fauna, furnishing as it does so many species not known in other faunas, seems to fully justify its separation from the faunas above and its recognition as the sole representative of the Kinderhook fauna in Indiana.

The Rockford fauna, which has heretofore been known only at Rockford, has been found in Jennings county and in the southern part of Scott county some thirty miles south of the original locality. The three or four feet of limestone to which it is confined contains at most localities very few or no fossils. The Rockford limestone, which is a persistent formation in southern Indiana, has not been seen south of the Ohio, and no trace of its fauna has been found in Kentucky. The Rockford limestone evidently disappears by thinning toward the south and is represented in the Kentucky sections by the greenish blue argillaceous New Providence shale. These argillaceous shales have been found at one point thirty miles south of Louisville to be separated from the Black shale by a few feet of shelly limestone. This limestone, which holds the same stratigraphic position as the Rockford limestone, was found to contain a fauna typical of the New Providence shale, no trace of the Rockford fauna appearing in it. The three species which were found abundantly here are *Rhipidomella oweni*, *Spirifer mortonanus*, and *Spirifer suborbicularis*. These fossils are found at nearly every locality where fossils occur in the New Providence shale, while they have never been found in the Rockford fauna. We have therefore conclusive evidence that the Rockford fauna and the New Providence fauna were contemporaneous and existed side by side over a portion of this area at the end of the Black shale epoch. Much more detailed information concerning the faunas succeeding the Black shale throughout the Mississippi valley is needed before a final and satisfactory correlation of the Rockford fauna in other states can be made. The field work of the writer has shown that the fauna is absent from the Kentucky sections and that the lower part of the New Providence shale is the stratigraphical equivalent of the Rockford limestones in Kentucky. From the local character of the fauna in this area we may fairly expect to find it absent and its interval represented by another fauna in some of the other states of the Mississippi valley. The writer cannot agree with Meek and Worthen's correlation of the Rockford limestone with the Chouteau limestone for reasons stated in reviewing that correlation. The evidence there cited seems to indicate the parallelism of the Louisiana limestone of Missouri with the Rockford limestone.

The presence of *Goniatites oweni*, together with nine other Rockford fossils, in the Marshall group of Michigan, which Winchell* has reported, indicates that the Rockford is represented in Winchell's Marshall group and that the Rockford limestone is the stratigraphic equivalent of some part of the Marshall group, but certainly not of all of it.†

The tables showing the range of the faunas in the Indiana and Kentucky sections indicate clearly that the fauna of the Rockford limestone is the earliest of the Carboniferous faunas in these sections. It may be designated faunally after the name of one of its most characteristic species as the *Munsteroceras oweni* zone of the Eocarboniferous.

RIVERSIDE SANDSTONE AND NEW PROVIDENCE SHALE FAUNAS.

The relation between the faunas of these two formations has been found to be of the closest kind. Neither of the formations is generally fossiliferous. In the lower especially fossiliferous localities are scarce, but when found the fossils are apt to be abundant. In both formations the faunas seem to have lived in colonies covering quite limited areas, with considerable stretches of uninhabited or at least very sparsely populated sea bottom between.

The sandstone in northern Indiana designated as the Riverside sandstone by Mr. Hopkins‡ has been correlated with the upper sandstone and sandshale of the Knob region in southern Indiana on the evidence of fossils collected at and near the typical locality. The following species were obtained:

Lingulodiscina newberryi, *Rhipidomella* sp., *Spirifer* sp., *Spirifer keokuk*, *Spirifer striatiformis*, *Spirophyton crassum*, *Syringothyris texta*, worm trails.

This is a characteristic fauna of the upper "Knobstone" of southern Indiana. *Syringothyris texta* and *Spirifer keokuk* are found at nearly all fossiliferous localities in these beds. *Spirifer keokuk* has never been found by the writer in the New Providence shale and *Syringothyris texta* is known to occur in those beds at only one locality.

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*Pr. Am. Phil. Soc., vol. 12, p. 396.

† " " " " " " " 397.

‡20th Ann. Rept. Ind. Dept. Geol., p. 287.

Brachiopods are more abundant than any other class of fossils in both faunas. Of those which have been positively identified ten are common to the faunas of the Riverside sandstone and the New Providence shale, while twelve species are recorded from the upper fauna which have not been seen in the lower fauna. *Rhipidomella oweni* is perhaps the most abundant and characteristic species of the New Providence shale, and the fauna associated with it may be designated as the *Rhipidomella oweni* zone of the Eocarboniferous.

Applying the same method of nomenclature to the fauna of the Riverside formations it may be called the *Reticularia pseudolineata* zone of the Eocarboniferous.

The distinctly Carboniferous character of these two zones is shown in the extreme scarcity of species which occur in the Devonian and the abundance of Carboniferous types. *Productus punctatus* and *P. semireticulatus* which have been found in these faunas are common Coal Measure species. *Eumetria marcyi*, which has been found in the *Reticularia pseudolineata* zone, is a common species in the St. Louis and the Kaskaskia limestones.

In correlating these faunas with those of the Mississippi series elsewhere it is probably not desirable or practicable to consider them separately. The Brachiopods are probably more reliable for this purpose than other groups, since recent studies have cleared up much of the synonomy involved. An examination of the Brachiopods listed in Part III, with reference to their recorded range elsewhere, shows the following facts: Eight are reported in the Burlington fauna, twenty-two in the Waverly, fifteen in the Keokuk, five in the Kinderhook, two in the Marshall, three in the Coal Measures, one in the St. Louis limestones and one in the Kaskaskia. The very close relationship discovered between the faunas of the Burlington and Keokuk limestones at the typical localities lad to uniting the two under the name of Osage by Williams. Keyes has since used the name Augusta for nearly the same beds as those included in the Osage. The figures shown in the above summary seem to point conclusively to the equivalence of the faunas of the Riverside sandstone and the New Providence shale to the Osage or Augusta group, the number of Brachipods common to the Indiana faunas and Osage group being twenty-three. Nearly the same number of species is common to the Waverly of Ohio and the Indiana faunas, and we may regard the Waverly fauna the equivalent in Ohio of the Riverside and New Providence shale faunas in Indiana. The small number of species common to these faunas and the Marshall of Michigan is probably due to the fact that very few of the Marshall species have been figured, which makes their identification in the Indiana faunas difficult and uncertain.

DEVONIAN FAUNAS.

REVIEW OF PREVIOUS CORRELATIONS.

The earliest attempts to classify the Devonian rocks of Indiana and Kentucky date back to the period when Wernerian ideas were dominant in Geology.

In 1819 W. B. Stilson,* following the example of McClure in applying the Wernerian system to American rocks, referred all of the horizontal strata of Indiana to the "Secondary formation."

In the following year Thomas Nuttall† attempted to classify the horizontal strata of Indiana and other states of the Mississippi valley, and referred them to the "Secondary formation."

As pointed out by Williams,‡ Lardner Vanuxem was one of the earliest, if not the first, in America to show the fallacy of the Wernerian system and to use fossils for purposes of correlation. In an article published in 1829 Vanuxem states his belief in the primary importance of the use of fossils in correlating rocks, in the following words: "The analogy or identity of rocks I determine by their fossils in the first instance and their position and mineralogical characters in the second or last instance."|| Other geologists were not slow to see the importance of this idea, and in

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*Sketch of the Geology and Mineralogy of a Part of the State of Indiana.—Am. Jour. Sci., vol. 1, 1819, pp. 131-133.

†Jour. Acad. Nat. Sci. Phila., vol. 2, 1821, p. 44.

‡Bull. U. S. G. S., vol. 80, p. 32.

||Am. Jour. Sci., vol. 16, 1829, p. 255.

most of the attempts to correlate the Indiana rocks with those elsewhere fossils have played an important part since that date.

In 1837 and 1838 D. D. Owen made a geological survey of Indiana.* In Owen's Report† published in 1839 all of the rocks in Indiana below the coal beds were referred to what Owen called the Sub-carboniferous group. This term was intended to indicate their position "immediately beneath the Coal or Carboniferous group of Indiana." Owen's Sub-carboniferous group was divided as follows:‡

Sub-carboniferous Group.
1. Oolitic limestones.
2. Silicio-calcareous series, with occasional beds of clay.
3. Black bituminous aluminous slate.
4. Fossiliferous and inferior strata of the Sub-carboniferous group, consisting of (1) Fossiliferous beds of the Ohio Falls; (2) Waterlime and variegated strata; (3) Sand or burrstone; (4) Bluish or brownish limestone.

The Devonian series in Indiana and Kentucky is represented in the above classification by number three and the first division of number four.

Owen correlated the Black shale at the base of the knobs in Indiana with a shale in Ohio at "the base of the hills capped with sandstone, bordering the Scioto valley."

In the first Report of the Kentucky Survey|| Owen modified the use of the term Sub-carboniferous so that it included only the rocks between the Coal Measures and the Black Lingula shales. In this report Owen divides the beds below the "Sub-carboniferous limestone and fine-grained sandstones" as follows:§

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*Am. Jour. Sci., vol. 34, 1838, pp. 193-196.
†Report of a Geological Reconnoissance of the State of Indiana.
‡Ibid, pp. 13-19.
||Rept. Ky. Geol. Surv., vol. 1, pp. 16, 17.
§Ibid, p. 16.

Black Lingula shales.

Grey Coralline Falls limestones.

Chain coral and Upper Magnesian Cliff limestone.

Blue, Shell, and Birdseye limestones of Fayette and Franklin counties.

In a report published in 1840* Owen made the following five divisions of the rocks in the states of Indiana, Ohio, Kentucky, and Tennessee:†

Pentremetal limestone, light-colored limestone, sometimes Oolitic.

Fine-grained sandstone in knobs.

Black bituminous shale.

Thick beds of yellow limestone, Cliff limestone of the west.

Blue fossiliferous shell limestone in thin beds with Marlite.

It will be noted that in the above classification the Devonian limestones are not separated from the Niagara, but included with the latter under the name of Cliff limestone of the West.

In the revised edition of Owen's Report published in 1844 the ''Black slate'' of Ohio and Indiana is considered the equivalent of the Marcellus shale of New York.‡

In 1841 Dr. A. Clapp, in a communication to the Philadelphia Academy of Science,|| correlated the limestone at the Falls of the Ohio with the Wenlock of Murchison by means of the fossils. The Black shale he considered to be the probable equivalent of the Marcellus shale of New York.

In a later communication§ the ''Water lime of the Falls of the Ohio,'' which is described as a drab-colored rock lying below the

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*Mineral Lands of the United States. Message from the president of the Jr. S. in reply to a resolution of the House of Representatives, Feb. 6, 1840. House of Representatives, Executive Document No. 239, Twenty-sixth Congress, first session.

†Ibid., diagram 4, p. 182.

‡Williams, Bull. U. S. G. S., 80, p. 140.

||Proc. Phila. Acad. Sci., vol. 1, 1841, pp. 18, 19.

§ " " " " " " " p. 178.

Black shale and separated from it by a few feet of fœtid limestone, is correlated with the middle or upper part of the Helderberg group.

In 1842 Prof. James Hall read a paper on the "Identity of Western Formations with Those of New York" before the Association of Geologists and Naturalists. In this he stated:* "In the Cliff limestone we have the Helderberg series of New York, or at least two persistent numbers, the Onondoga and Corniferous, with the Water lime and perhaps a meagre representation of the Salt group, together with the Niagara limestone."

Of the Black shale Hall says that "it seems to be the equivalent of the Marcellus of New York and is the only representative of that rock the Hamilton group and the Genesee slate."†

Prof. H. D. Rogers,‡ in discussing Hall's opinion of the age of the Black slate, stated that he could find no trace of the Hamilton group in the west and regarded the Black shale as the equivalent of the Marcellus shale alone.

In a paper before the Association of Geologists and Naturalists in 1843 D. D. Owen expressed the opinion that the Black shale of Indiana and Kentucky was the equivalent of the Marcellus.‖

It is to Edward de Verneuil that we are indebted for a correlation of the Paleozoic formations of Indiana and Kentucky which has been very slightly modified by subsequent investigations. M. de Verneuil's views on the parallelism of American and European formations were published in 1847.§ The classification of the Paleozoic rocks of Ohio, Kentucky, and Indiana proposed by de Verneuil is as follows:¶

Carboniferous System.	8. Sandstones, shales, and limestones of the Coal. 7. Carboniferous limestone. 6. Fine-grained micaceous sandstone.

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*Trans. Am. Assoc. Geol. and Nat., p. 279.
†Ibid, p. 280.
‡Am. Jour. Sci., vol. 45, 1843, p. 161.
‖ " " " " " " " 152.
§Soc. Geol. France, Bull., 2d ser., vol. 4, 1847, pp. 646-709.
¶Am. Jour. Sci., vol. 5, 2d ser. 1848, p. 183.

Devonian system.	5. Black bituminous schists. 4. Shelly limestone and coralline limestone.
Silurian System. (Superior.)	3. Silicious or magnesian limestone (Cliff limestone).
Silurian System. (Inferior.)	2. Blue limestones and marl. 1. Compact limestone.

Regarding the correlation of the Devonian of Indiana and Kentucky with the New York Devonian, de Vernueil states that "in the states of Ohio, Indiana and Kentucky it is reduced to the black shists which represent the Genesee slate and to a calcareous band which represents at once the Corniferous and Onondaga limestone and the Hamilton group of the state of New York."*

In 1851 Prof. Hall published a paper on the "Parallelism of the Palæozoic Deposits of the United States and Europe." Hall seems inclined in this paper to accept de Verneuil's view of the age of the Black shale of the west and says "it may be a representation of the Genesee slate of New York, but holds the place of the Marcellus shale, resting directly upon the Corniferous limestone."† It is apparent from this quotation that Prof. Hall did not recognize any representative of the Hamilton in Indiana and Kentucky at the time it was written. This view he continued to hold for some time. Eleven years later, in speaking of the age of the Goniatite beds at Rockford, Ind., he says: "As the Hamilton group has not been recognized in the south part of Ohio or Indiana, so far as I know, there may yet be room for doubt as to whether this group thins out beneath the Black shale or above it; or, in other words, whether the Black shale of southern Ohio and Indiana, and of Kentucky and Tennessee, may be the continuation of the Marcellus shale or the Genesee slate."‡

Sidney Lyon and S. A. Casseday seem to have recognized the Hamilton at the Falls of the Ohio as early as 1859; for in referring a crinoid described by them to its geological horizon they state that it is found "in the Devonian rocks of the age of the Hamilton group."[*]

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*Am. Jour. Sci., vol. 5, 2d ser., 1848, p. 370.

†Report on the Geology of the Lake Superior Land District, 1851, p. 307.

‡15 N. Y. Regents' Report, 1862, p. 81.

In a paper published by Sidney Lyon[†] in 1860 he gives the following classification of the Sub-carboniferous series:

Sub-carboniferous Series.	n. Cavernous limestone.
	o. Middle limestone.
	p. Sandstones and shales.
	q. Black slate.
	r. Encrinital limestone.
	s. Hydraulic limestone.
	t. Spirifer bed.
	u. Nucleocrinus bed.
	v. Turbo bed.
	w. Coral beds.
	x. Catenipora beds.

Lyon attempts no correlation in this paper of the beds below the Black shale, but is inclined on the evidence of the Rockford Goniatites to place it higher than the Devonian.

In 1860 Hall[‡] had expressed the opinion that the Black shale in Indiana was the "continuation of the Marcellus shale," and that the Rockford limestone was of the same age.

Meek and Worthen[||] pointed out the error of this correlation of the Rockford limestone during the next year and affirmed the Genesee age of the Black shale.

The Report of the State Geologist of Indiana for 1873[§] contains the following classification of the Devonian in Clark and Floyd counties:

New Albany Black slate.	Hamilton group	140
Crinoidal limestone.		
Hydraulic limestone.		
Corniferous limestone.—	Upper Helderberg group	22

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[*] Am. Jour. Sci., 2d ser., vol. 28, 1859, p. 244.
[†] Trans. St. L. Acad. Sci., vol. 1, 1859-60, pp. 612-622.
[‡] 10th N. Y. Regents' Report, 1860, p. 96.
[||] Am. Jr. Sci., 2d ser., vol. 32, pp. 167-177.
[§] P. 172.

The Indiana Geological Report for 1874 contains a report on a collection of Black shale fossils which were submitted to Mr. R. P. Whitfield. The study of these led Whitfield* to the conclusion that the Black shales of Indiana "are in part at least equivalent to those known as the Genesee slates of New York," and "that they represent an equivalent in time to that of the entire Hamilton epoch as represented in New York, and perhaps even some of the overlying beds."

In 1877 Prof. Shaler† stated that he considered the Black shale in Kentucky to represent the whole of the Devonian down to the top of the Oriskany. This conclusion is based upon the apparent conformity of the Black shale with supposed Oriskany sandstone in Central Kentucky.

Previous to 1879 Prof. Hall had considered the Devonian limestone in southern Indiana to represent only the Upper Helderberg group. The Hamilton, if present at all, he considered to be represented by some part of the Black shale. In the Report on the Paleontology of New York‡ published in 1879 he published a very instructive tabulation of the Hamilton species which he had recognized in the "Hydraulic beds and associated limestones at the Falls of the Ohio." He concludes from the evidence presented that the "Hydraulic and Encrinital limestones" at the Falls of the Ohio are the equivalent of the Hamilton. In the same paper Hall reviews the question of the age of the Black shale in Indiana and states that "the Black shale of the west is equivalent and even the absolute continuation of the Black shales succeeding the Hamilton group of New York (the Genesee slate)."||

In 1884 John Collett, State Geologist of Indiana, published a geological map§ and section of the State in which the Hamilton is not recognized. The following classification of the formations between the Coal Measures and the Upper Silurian is given:

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*6th Ann. Rept. Ind. Geol. Surv., pp. 181, 182.

†Ky. Geol. Surv., n. 3, vol. 3, pp. 173, 174.

‡Pal. N. Y., vol. 5, pt. 2, pp. 139-154.

||Ibid, p. 152.

§13th Rept. Ind. Dept. Geol. and Nat. Hist.

- Lower Carboniferous.
  - Chester group.
  - St. Louis group.
  - Keokuk group.
  - Knobstone group.

- Devonian.
  - Black slate, or "Genesee shale."
  - Corniferous.

Maurice Thompson in his first report gives the same classification of the Devonian as Collett and states that "the Corniferous rocks and the Genesee shale are the two numbers of the Devonian found in Indiana."[*]

In 1897 Prof. H. S. Williams published a paper "On the Southern Devonian Formations."[†] No direct reference is made to the region under consideration in this paper, but the idea is presented that the upper and lower limits of the "Black shale" formation may vary with reference to the time scale in different regions, and that the formation contains locally, at least, Eocarboniferous faunas.

The Report of the Indiana State Geologist for 1897 contains a paper on the "Geological Scale of Indiana" by Blatchley and Ashley. The authors recognize three divisions of the Devonian in Indiana—the New Albany or Genesee shale, the Hamilton, and the Corniferous. The Hamilton is recognized in the northern part of the state on the authority of Dr. Phinney, but the authors state that "the formation has not been recognized in southern Indiana."[‡] No evidence is offered in connection with this statement to show that Hall's[||] determination of the Hamilton in southern Indiana is incorrect.

CORRELATION OF FAUNAS.

It has been shown in another part of this paper that the New Albany shale and the beds below it are unconformable south of Louisville. As a result of this unconformity the Devonian limestone is pretty generally wanting or very thin in Kentucky. The Sellersburg beds and their fauna have not been seen at all south of Louisville.

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[*] 15th Rept. Ind. Dept. Geol. and Nat. Hist., 1886, p. 11.

[†] Am. Jr. Sci., vol. 3, 1897, pp. 393-403.

[‡] 22d Ann. Rept. Ind. Dept. Geol. and Nat. Res.

[||] Pal. N. Y., vol. 5, pt. 2, pp. 139-154.

The preceding review of the history of the attempt to correlate the Devonian of Indiana and Kentucky with the New York Devonian has shown that the difficulties encountered were chiefly in connection with determining the equivalents of the faunas above the Corniferous. The Corniferous fauna of New York suffers no very important modifications in its western extension. The large number of species common to the fanuas of the Corniferous limestone of New York and the Jeffersonville limestone, especially among the corals, leaves no doubt as to the equivalence of the two faunas. One of the most abundant and characteristic species of this fauna in Indiana and Kentucky is *Spirifer acuminatus*. It is proposed to designate this fauna as the *Spirifer acuminatus* zone of the Eodevonian.

In southern Indiana we find in the Sellersburg beds a fauna containing many of the most characteristic species of the Hamilton of New York. Among the characteristic New York Hamilton Brachiopods which occur in these beds and which are unknown in the Corniferous may be mentioned *Spirifer granulosus*, *Tropidoleptus carinatus*, *Chonetes coronatus*, and *Pentamerella pavilionensis*. Of the Lamellibranchs which are abundant in the New York Hamilton we have in the Sellersburg beds *Pterinea flabella*, *Modiomorpha concentrica*, and *Aviculopecten princips*. Many other species occur in these beds which are common both to the Hamilton and Corniferous of New York. In southern Indiana this fauna is not mingled with the Corniferous, as was once supposed, but occurs above that fauna in the Sellersburg beds. The presence in it of such characteristic Hamilton fossils as those mentioned seems to leave no doubt of its equivalence to the New York Hamilton. This fauna may be designated as the *Spirifer granuliferus* zone of the Mesodevonian.

The New Albany shale has offered a more difficult problem in correlation than has either of the other Devonian formations. When the first attempts were made to correlate it with the New York scale its known fauna was limited to one or two *Lingulæ*. The Hamilton fauna at its base had not been recognized and the formation was correlated mainly on stratigraphic grounds with the Marcellus.

Carboniferous faunas appear immediately above the New Albany shale in Indiana and Kentucky, but they have nowhere been found in it by the writer.* The following is a list of the rather meagre fauna at present known from the New Albany shale in Indiana and central Kentucky†:

Barroisella subspatulata, *Cardiopsis* sp., *Chonetes lepidus*, *Chonetes scitulus*, *Discina minuta?*, *Discina truncata*, *Leiorhynchus limitare*, *Leiorhynchus quadricostatum*, *Lingula ligea*, *Lingula spatulata*, *Panenka radians?*, *Styliola fissurella*.

A summary of the evidence which these species afford as to the age of the fauna shows that the range of three of them is from the Marcellus or Hamilton to the Chemung and of one, from the Hamilton to the Portage, inclusive. Leaving out of consideration *Panenka radians* and *Discina minuta*, which have been doubtfully identified, and *Barroisella subspatulata*, which is not known in the New York faunas, we find but one of the species limited to beds below the Genesee. Of the others, one is common to the Portage and the Genesee; another ranges throughout the Hamilton, while three are characteristic Genesee species. The weight of the evidence seems therefore in favor of the equivalence of the faunas of the Genesee and the New Albany shale.

Probably no other species occurs in such abundance in the New Albany shale as *Styliola fissurella*. The fauna may be conveniently designated as the *Styliola fissurella* zone of the Devonian in this series of sections.

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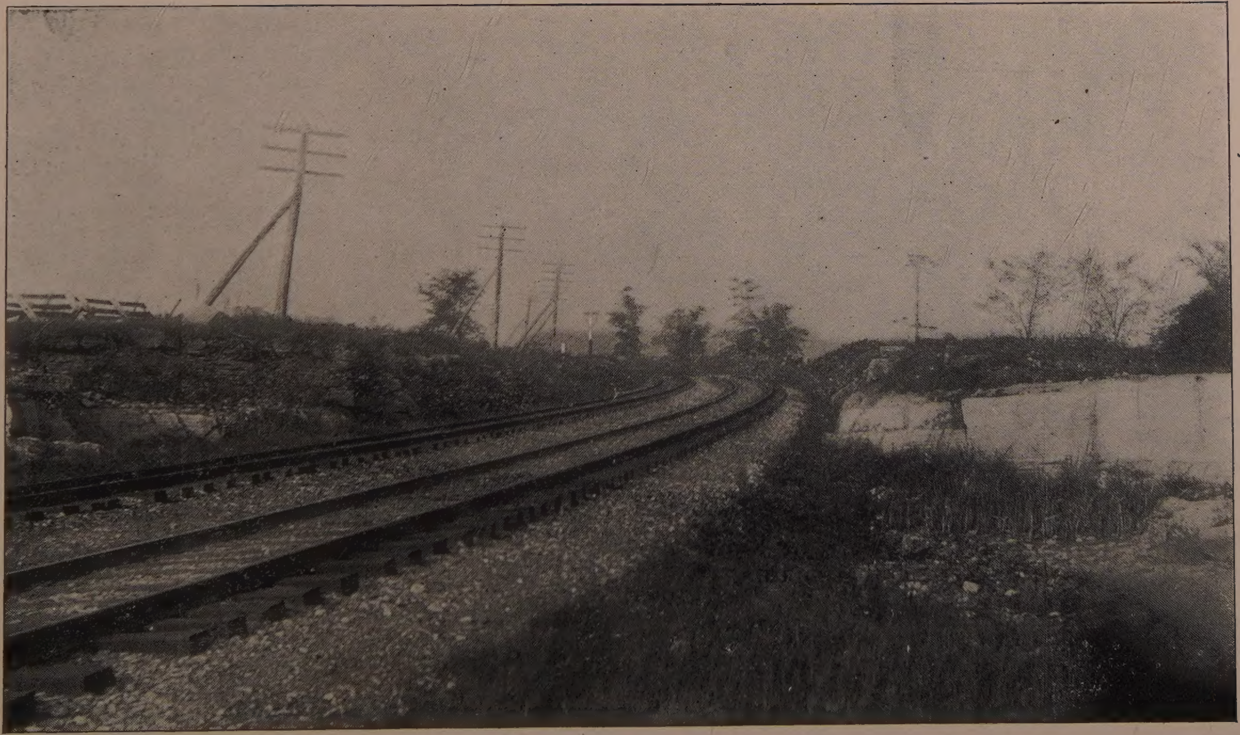
*Prof. Williams reports a Carboniferous fauna in the Black shale at Irvine, Ky. Am. Jr. Sci., 4th ser., vol. 3, p. 398.

†A few species not included in this list have been reported by Girty from the Black shale of eastern Kentucky. Am. Jr. Sci., vol. 6, 4th ser., pp. 384-395.



Cut on West Shore Railroad, Wemple Farm, near Ft. Hunter, N. Y.